

**LEGAL ISSUES REGARDING HELIUM-3 – THE SOLUTION TO THE
WORLD’S ENERGY CRISIS**

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ABSTRACT

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This thesis assesses the current global legal framework regarding helium-3. The paper's analysis focuses on two specific fields: dual-use goods and laws of outer space, especially concerning space resources. These matters are approached through four research questions. Concerning outer space, the research questions are: what is the current status of the laws surrounding the mining of space resources, and how should this legal framework be amended, changed, or re-interpreted to enable the commercial mining of helium-3 in outer space? Concerning dual-use goods, the research questions are: what is the current status of the legal framework surrounding helium-3 as a dual-use item, and how should this legal framework be amended, changed, or re-interpreted to enable the efficacious use of helium-3 in technological applications while ensuring that the legislation is neither under-inclusive nor over-inclusive.

Making the usage of helium-3 feasible is arguably part of a possible solution for solving the world's energy crisis. The obstacles to this goal are the high price of helium-3 and its potentially dangerous uses in the proliferation of nuclear weapons. The former is due to helium-3's scarcity on Earth, and the latter due to its role in manufacturing nuclear weaponry.

Helium-3 is abundant on the Moon. However, space law's current legal framework does not allow the exploitation of resources from celestial bodies. Even if the exploitation were made possible, the issue of dual-use regulations would still be present. These strict export controls make the utilization of helium-3 difficult and expensive. To make the usage of helium-3 feasible and to solve the ongoing energy crisis, altering these frameworks must be discussed. These matters are explored by utilizing the method of legal dogmatism and functional comparative law method.

This thesis concludes that the current legal framework of helium-3 does not enable its efficient utilization. Both international space law and the dual-use framework need to be amended. Space treaties need to be reworked and modernized, starting with the Moon Agreement, which is lacking wide acceptance. Concerning dual-use goods, harmonization is required to lessen the burden on the shoulders of technology companies. In addition to this, strengthening the Wassenaar Arrangement increases the export control regime's transparency and efficiency.

Keywords:

International law, technology, dual-use goods, space law, helium-3, nuclear proliferation, energy crisis

TABLE OF CONTENTS

Table of contents	III
Sources	IV
1 Introduction	1
1.1 Background	1
1.1.1 <i>International space law pertaining to helium-3</i>	2
1.1.2 <i>Dual-use regulation surrounding helium-3</i>	7
1.2 Research questions, limitations, academic context, and audience	9
1.3 Research method and theory background	11
1.4 Structure	12
2 The legal frameworks surrounding helium-3	14
2.1 Helium-3's status as a dual-use item	14
2.1.1 <i>General overview of the dual-use regimes</i>	14
2.1.2 <i>Voluntary multinational agreements</i>	16
2.1.3 <i>The legal framework of dual-use goods in the EU</i>	19
2.1.4 <i>The legal framework of dual-use goods in the United States</i>	22
2.2 Helium-3 and the laws of outer space	23
3 Principles of international law concerning helium-3	28
3.1 Subjects and objects of international law	28
3.2 The principles of international law concerning dual-use items	30
3.3 The principles of international law concerning outer space resource exploitation	33
4 The application of the legislation surrounding helium-3	35
4.1 Application of dual-use goods regulations	35
4.1.1 <i>The dangers of under-inclusiveness and the legality of nuclear weapons</i>	35
4.1.2 <i>The harm of over-inclusiveness</i>	38
4.2 How the laws of outer space restrict acquiring helium-3	39
4.2.1 <i>The common heritage principle and the principle of non-appropriation</i>	39
4.2.2 <i>The Commercial Space Launch Competitiveness Act of 2015</i>	46
5 Alternative solutions to the legal framework surrounding helium-3	48
5.1 Alternative solutions for regulating dual-use goods	48
5.2 Alternative solutions to the legal framework surrounding outer space resources	50
6 Conclusions	52

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Abbreviations

Agreement Governing the Activities of State on the Moon and Other Celestial Bodies	Moon Agreement
Agreement on Trade-Related Aspects of Intellectual Property Rights	TRIPS
Bureau of Industry and Security	BIS
Commerce Control list	CCL
Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space	Outer Space Treaty / OST
Deep Seabed Hard Mineral Resources Act	Seabed Act
EU General Export Authorisation	EUGEA
European Union	EU
Export Administration Regulations	EAR
Export Control Classification number	ECCN
Hague Code of Conduct against the Proliferation of Ballistic Missiles	HCoC
International Court of Justice’s	ICJ
International Seabed Authority	ISA
International Traffic in Arms Regulations	ITAR
International Tribunal for the Law of the Sea	ITLOS
Missile Technology Control Regime	MTCR
National Aeronautics and Space Administration	NASA
National General Export Authorisation	NGEA

Nuclear Proliferation Treaty	NPT
Nuclear Supporters Group	NSG
The International Covenant on Civil and Political Rights	ICCPR
The Nuclear Suppliers Group	NSG
The second list for certain items is the Munitions List	USML
United Nations	UN
United Nations Convention on the Law of the Sea of 1982	UNCLOS
United States	U.S.
United States Code	USC
Wassenaar Arrangement	WA
Weapons of mass destruction	WMD
World Trade Organization	WTO

1 INTRODUCTION

1.1 Background

The energy crisis is one of the most serious issues the world is currently facing. Especially in the less developed regions of the world, there is a bottleneck in energy production compared to energy consumption. This bottleneck is caused by multiple factors, including the ever-growing energy demands, the middle-classification of the world's more impoverished regions, and the rapid growth of the global population. Alongside the issue of there not being enough energy, much of the contemporary energy production is unclean. Especially developing countries around the world are still generating most of their energy by heavily polluting and inefficient means, which in turn is a driving force for climate change. While many proposed solutions to this problem come in the form of strict consumption taxes, some of the most prominent solutions tend to focus solely on generating more energy – cleanly.¹

As prominent as these new solutions might sound, the utilization of many of them would require the alteration of existing legal frameworks, and changing policies, especially on an international level, is not an easy feat. The ever-so-quickly developing field of high technology has placed an enormous pressure on the legal field both nationally and internationally. Pre-emptive lawmaking has become a near impossibility as the process from drafting a law to passing it is lengthy and burdensome, while a single new technological invention can revolutionize the world and hence create a chaotic battlefield for legislators virtually overnight. One of the items enabling the creation of inventions with such chaotic capabilities is helium-3.²

Helium-3 is a substance used widely in many high-tech implementations due to its many extraordinary physical properties. It is, for example, possible to cool the substance's temperature close to absolute zero while it still maintains its liquid form. This enables the substance to be used in many high-tech applications, ranging from enhancing medical imaging done by CT-scanners, to enabling quantum computing by lowering the temperature of the quantum chips just a few kelvins above absolute zero. However, arguably the most remarkable use for helium-3 is its capabilities in generating clean nuclear energy with nuclear fusion.

¹ See e.g. Martin, 7.9.2015 and the Economic Times Spotlight team 19.2.2016.

² See e.g. Griffith 12.4.2019.

Hence, it has become one of the leading candidates for solving the global energy crisis by being potentially more efficient and cleaner than our current methods of generating nuclear energy.³

Helium-3 is a stable isotope of helium found relatively scarcely on Earth. Out of all the helium present on Earth, only 0.000137% is of this isotope.⁴ Helium-3's price follows suit with its scarcity: a kilogram of helium-3 costs 1,400,000 dollars.⁵ As a comparison, many modern nuclear power plants currently in development are designed to utilize thorium-232 instead of uranium-235 in their reactions. The price of a kilogram of thorium-232 is negligible compared to that of helium-3, standing at roughly 30 dollars per kilogram.⁶

Unlike the contemporary methods of generating nuclear energy, generating fusion energy with helium-3 is nearly 100% clean: the reaction produces little to no waste and almost no radiation.⁷ There are, however, three caveats concerning utilization of helium-3 when generating energy using nuclear fusion: helium-3 power plants are currently only feasible on paper,⁸ the substance is immensely scarce on Earth, and it can be used to create nuclear weaponry. To discuss the two latter issues, this paper explores the international laws governing outer space and the legal regimes concerning dual-use goods.⁹ Anyone not familiar with these topics might be confused: what does any of this have to do with outer space? And what on earth are dual-use goods? Let us explore the former first.

1.1.1 International space law pertaining to helium-3

To solve the issue of the scarcity of helium-3, we must look at the international law surrounding outer space. There is a problematic absence of helium-3 on Earth. With the demand of helium-3 growing higher as more and more technological innovations start utilizing the substance, the prices keep rising accordingly. In energy generation, massive quantities of fuel are required. If, and hopefully when, energy positive nuclear fusion is made possible for this kind of operation to be cost-effective, one would have to have helium-3 available in large quantities, and for the

³ Barnett 30.1.2016.

⁴ Chemical Book 2017.

⁵ Schmit 30.11.2016, p. 5.

⁶ Surampalli 13.8.2019, price reference from Indiamart (23.1.2021).

⁷ Barnett 30.1.2016.

⁸ Scientists have attempted to create energy positive helium-3 fusion reactors for decades. To this date no large-scale energy-positive helium-3 fusion reactions have been achieved. New experiments have, however, gotten closer and closer to this goal. This matter, however, falls outside of the scope of this research paper due to its technical nature. To read more on the difficulties facing nuclear fusion using helium-3, see e.g. Plasma Science and Fusion Center 14.10.2016 and Yanes 14.3.2019.

⁹ Barnett 30.1.2016.

price of helium-3 to drop to a number enabling the profitability of such an operation. The issue is that helium-3 is so scarce and so expensive that the costs of such use would become unreasonably high; thus, the alternative of less clean methods would still prevail. To solve the energy crisis, cheaper, more efficient, and cleaner energy production solutions are needed. Having more helium-3 available and thus lowering its price is a good first step towards the right direction in enabling the efficient research and hopefully, in the future, cost-efficient utilization of helium-3 in power generation. But to lower the price, applying the basic economic principle of supply and demand, more helium-3 needs to enter the market. But how do we get more helium-3 when there is barely any of it here on Earth? The answer appears bright in our skies every single night: the Moon.

“Why would one conduct mining operations in space?” one might ask. Celestial bodies, including the moon, are home to a vast number of resources, including rare earth metals used in many of today’s modern technological appliances. The value of the resources on these asteroids is astronomical, rising up to hundreds of trillions of dollars. However, the more accessible near-Earth asteroids are currently the main interest of humanity. Even though these asteroids are not home to tens or hundreds of trillions of dollars in valuable metals, many of them have been calculated to have enough resources for a successful mining operation to be able to generate tens of billions in profits.

Name	Estimated value (\$)	Estimated profits (\$)
Ryugu	82.76 billion	30.08 billion
1989 ML	13.94 billion	4.38 billion
Nereus	4.71 billion	1.39 billion
Bennu	669.96 million	185.00 million
Didymos	62.25 billion	16.41 billion
2011 UW158	6.69 billion	1.74 billion
Anteros	5.57 trillion	1.25 trillion
2001 CC21	147.04 billion	29.77 billion
1992 TC	84.01 billion	16.78 billion
2001 SG10	3.05 billion	544.48 million

The ten asteroids considered to be the most cost effective for potential mining operations.¹⁰

¹⁰ List and value estimates from asterank.com. For more information on the specific physical features and the compositions of the said asteroids, visit Asterank’s website.

Moving further away from near-Earth asteroids, one can find asteroids of immense value. For example, one of the most valuable asteroids discovered, consisting almost entirely of different metals named Psyche 16, is estimated to be around \$10,000,000,000,000,000,000 in value. For perspective, the value of Psyche 16 is approximately 70 000 times greater than the entire global economy.¹¹

Besides the rare-earth metals, certain solar bodies contain an abundance of helium-3. One of the most notable and easily accessible of these celestial bodies is our Moon, which is known to hold vast amounts of the substance.¹² As far-fetched as it might sound, it is relatively inexpensive to get to the Moon with modern equipment, especially compared to the era of early American Apollo missions and Soviet Union's Sputnik launches. The recent advances in rocket technology, arguably most notably *SpaceX's* reusable rocket boosters, have brought the possibility of mining resources from the Moon profitably more available than ever before. One might wonder: "Why has no one conducted a mission to mine it commercially?" This seems like an easy decision: there is an issue, there is a solution, and that solution is highly profitable and potentially beneficial for all mankind. One major factor contributing to the lack of commercial space resource mining operations lies in international space law.

There are five treaties governing space law. Namely:

1. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, referred from hereon as the Outer Space Treaty (OST);
2. Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, referred from hereon as the Rescue Agreement;
3. Convention on International Liability for Damage Caused by Space Objects, referred from hereon as the Liability Convention;

¹¹ Cormack 2.11.2020, for a more detailed explanation, see Becker – Cunningham – Molyneux – Roth – Feaga – Retherford – Landsman – Peavler – Elkins-Tanton – Walhund 2020.

¹² See e.g. European Space Agency "Helium-3 mining on the lunar surface".

4. Convention on Registration of Objects Launched into Outer Space, referred from hereon as the Registration Convention; and
5. Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, referred from hereon as the Moon Agreement.

The treaties concerning the laws of outer space can be considered hard law. United Nations' (UN) principal legal officer Arnold Pronto writes regarding the matter of hard and soft law:

“The first type of rule is that which is encapsulated in a “hard” form and accordingly is legally binding on the parties to the agreement. It is well accepted that treaties are a form of “hard” law par excellence. The Statute of the International Court of Justice lists international conventions among the existing forms of international law. The underlying basis for the binding nature of treaties is the principle of pacta sunt servanda, which is explained in the Vienna Convention on the Law of Treaties, 1969, in the following terms: “Every treaty in force is binding upon the parties to it and must be performed by them in good faith.”¹³

Pronto continues by explaining how solely the binding nature of the treaties does not constitute the entire treaty to be hard law. Some provisions of the article may still be in a soft form, e.g., the UN Convention on the Law of the Sea of 1982 (UNCLOS) includes provisions formulated in a permissive manner. As one example, the treaty stipulates: “[a] coastal State may adopt laws and regulations, in conformity with the provisions of [the] Convention and other rules of international law, relating to innocent passage through the territorial sea.” By having the “may adopt” word choice, the treaty becomes permissive. The space treaties, however, are written in a binding manner, arising non-permissive obligations.¹⁴

Although being hard law, in certain places the international space treaties create a legal framework too loose to draw definite conclusions from and yet tight enough to suffocate any potential attempts of private space organizations to gather resources from outer space. This is largely due to the vague nature of certain provisions of the space treaties which have been left open for interpretation for decades. The matters of non-appropriation and the common heritage principle are great examples of such vagueness: both principles are laid down in space treaties, but their implications and concrete effects are left open-ended. The vagueness is further

¹³ Pronto 2015, p. 950–955.

¹⁴ Id.

emphasized by scholars disagreeing on many of the more debated topics, including the two aforementioned principles, and the Moon Agreement's questionable status, as it is only ratified by a handful of states. This matter is discussed further in chapters 3.3 and 4.2.1.

International law concerning outer space does not in its current form support gathering resources from celestial bodies, including the Moon, for anything other than scientific purposes. The issue lies in two aforementioned controversial principles laid in international space legislation: the principle of common heritage and the principle of non-appropriation.

The common heritage principle is a principle laid out in the international space treaties stating that no one may own any celestial bodies, including planets, Moons, and asteroids or parts of them, including the resources on these bodies, thus also including helium-3. Instead, they are for all mankind to benefit from – and the uncertainty concerning what this specifically entails is the cause of much debate. There is no coherent and unified view on how the common heritage principle is to be applied in practice to the resources gathered in outer space, especially concerning private actors.

The second much-debated principle, the principle of non-appropriation, can be found from Article II of the Outer Space Treaty:

“Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means”¹⁵

This creates another issue: due to the wording of this article, it is not entirely clear whether or not this prohibited national appropriation also extends to private entities, and scholars are not unanimous about this matter either. This matter shall be looked more deeply into in chapter 4.2.1.

Any disputes arising from the breach or a potential misinterpretation of these principles would be problematic, as there is no separate dispute settlement body for disputes arising from the space treaties. The lack of arbitration and dispute resolution has for the longest time been a major issue in the field of space law. Recent developments, namely the Permanent Court of Arbitration's optional rules of 2011 regarding the matter, have shined a light on this gray area, well-explained by an Associate Editor of the Yearbook of Arbitration Jesse Baez:

¹⁵ Zhukov – Kolosov 2014, p. 48–50.

“Arbitration and alternative dispute resolution do not have an established presence in disputes that reach above Earth’s atmosphere. Traditionally, outer space was the purview of nation-states. The foundation of space law consisted of international treaties, as well as domestic laws issued by various countries. As a result, disputes that occurred in outer space were resolved by government agencies and diplomats while legal dispute resolution mechanisms were eschewed.”¹⁶

As there is no authoritative governing and enforcing body in the matters of space law, the incoherency brought forth by the vague wordings and different interpretations of the treaties have remained unsolved for decades. The uncertainty caused by this hinders the development of better and more efficient technologies. Investing millions of dollars into inventing new technologies that might not even be legal to use due to restrictions in international space laws bears serious risks.

Even if in the future international space laws would be amended in a way that would clarify these ambiguities, the issues of helium-3’s legal framework would not be over yet. After exploring the issue of helium-3’s scarcity, we have to address the second major issue that lies here on Earth: helium-3’s strict export controls due to the possibility of it being used in the creation of nuclear explosives.

1.1.2 Dual-use regulation surrounding helium-3

Dual-use goods include items, goods, and technologies that can be utilized both for peaceful civil purposes and for military uses. The export, transfer, and brokering of these items are often strictly monitored. The term “dual-use goods” covers a multitude of different industries, including telecommunications, software, biological, chemical, and nuclear. For example, such an item could be a certain dangerous chemical used in the creation of biological weapons, many kinds of decryption and encryption software, and a vast list of materials that can be used in the creation of nuclear weapons. The topic of this paper, helium-3, is classified as a substance with the capability of being used in the creation of nuclear weapons, and its exports are thus controlled.¹⁷

Due to the dual-use nature of the goods, the access to them, their exporting, and their brokering is restricted in a multitude of different ways. These policies and the rules set in place to control

¹⁶ Baez 2012, p. 218.

¹⁷ Micara 2012, p. 578–579.

exports differ from state to state and, in some cases, from region to region. These export control¹⁸ restrictions are set in place for clear reasons: under-inclusiveness of the rules concerning exports¹⁹ might potentially lead to disastrous results. However, the over-inclusiveness of the rules might create a strain for national economies and businesses within them. Balancing between these two issues and trying to create just the right amount of regulation is a difficult feat. These systems are complex and bureaucratic, making the selling, transferring, brokering, and exporting helium-3 and products utilizing it substantially more difficult, especially when engaging in cross-border transactions. These topics are discussed in more detail later in this paper.²⁰

The actors and the entities this legislation perhaps most notably affects, regarding both the transferring and utilization of dual-use goods, are private organizations often in the field of high-tech. Since much of the knowledge, materials, and parts required for these applications are scarce, these companies are often forced to be international by nature. While there exist international treaties and voluntary agreements to govern this matter to some extent, dual-use goods are also regionally governed. On top of all the international treaties, agreements, and the European Union's (EU) regulations concerning the prevention of nuclear proliferation, dual-use goods are also regulated in the national legislations of many countries.

The most important treaty concerning nuclear proliferation is the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). According to the UN, NPT's three objectives are as follows:

“to prevent the spread of nuclear weapons and weapons technology, to promote cooperation in the peaceful uses of nuclear energy and to further the goal of achieving nuclear disarmament and general and complete disarmament.”²¹

¹⁸ A good definition of export controls in the light of weapons of mass destruction can be found in Alavi – Khamichonak 2017 p. 59–60: “Export control is a trade instrument of upholding international security objectives in the framework of non-proliferation of weapons of mass destruction (WMD). With the emergence of various forms of terrorism and the efforts of state and non-state actors to acquire WMD and complementary technologies, the threats to security and safety are at their highest, and so it entails the necessity of maintaining an up-to-date and efficient system of export controls. Truly, “export control is political, multilateral, and event-driven”, which means that each country responds to the changes in internal, regional and international security with its own interpretation of and its own needs-based set of export controls provisions”.

¹⁹ In this thesis, when the terms “exporting” and “exporter” are used, the transfer, and brokering (and in some cases receiving) of such goods are also implied.

²⁰ Alavi – Khamichonak 2017, p. 60, and European Commission 2011.

²¹ United Nations Office for Disarmament Affairs 2020.

The NPT can be considered hard law although it is soft in its enforcement.²² It could be said that the NPT works as the standard and the general legal framework for export control, whereas the regional and national export control systems are a more fixed and pinpointed set of rules. The enforcement and dispute settlement concerning the rules set forth in the NPT are governed by the UN Security Council. The security council can propose sanctions to violators under Chapter VII of the UN charter, although no such claim has yet succeeded.²³ In addition to the aforementioned sets of rules, there are multiple voluntary agreements governing dual-use goods and their export controls. These shall be described in detail in chapter 2.1.2.²⁴

1.2 Research questions, limitations, academic context, and audience

There are four main research questions being explored in this thesis, all revolving around the current legal frameworks surrounding helium-3. When exploring the framework of outer space law, the research questions explored are the following: what is the current status of the law surrounding the mining of space resources, and how should this legal framework be amended, changed, or re-interpreted for it to enable the commercial mining of helium-3 in outer space? Concerning the legal framework of dual-use goods, the research questions are the following: what is the current status of the legal framework surrounding helium-3 as a dual-use item, and how should this legal framework be amended, changed, or re-interpreted in order to enable the efficacious use of helium-3? These questions are explored especially in the light of the frameworks' implications on mass-scale operations and businesses in the high-tech field, whilst taking into account the possible under-inclusiveness or burdensome over-inclusiveness of said frameworks.

This thesis refrains from dwelling too deeply into national legislations, as the number of slightly differing national legal systems concerning both export controls and space law is too great to be analyzed by one person alone. As an exception to this rule, this paper observes the legal systems of the few states being the biggest and most researched actors in the given fields. When researching dual-use goods, this thesis focuses mainly on the legislations of the EU and the

²² See e.g. Williamson 2003, p. 74–75.

²³ See e.g. Fleck 2016, p. 399.

²⁴ The chapters following focus more on the legal theory of the subject in hand. As the target audience of this research paper is both academics (especially policy makers and government officials) and the general public (anyone interested in the matter or technology companies that might be struggling with the topic themselves), the general public might be more interested in the less theory-focused chapters, such as chapter 1.1, chapter 3.2, chapter 3.3, chapter 4.1, chapter 4.2.1, and the conclusive chapter 6.

U.S.²⁵, in addition to certain collaborations and agreements between states and related international treaties. Regarding outer space law, in addition to the international space laws, this thesis focuses solely on the states with the most realistic capacities to conduct operations in outer space, namely the United States, China, Russia (and the former Soviet Union), Japan, EU (or more accurately the European Space Agency), and India, while also exploring possibilities to ensure that the rights of the less developed non-space-faring states are taken into account as fully as possible.

There are multiple research papers written on both the laws of outer space and the dual-use goods regimes. However, not much research, if any, concerning both of these topics combined has been conducted, let alone those research papers being associated with helium-3. However, in order to effectively utilize helium-3, both of these matters need to be addressed. This paper attempts to bring the attention of both legal academics and the wider general public to this issue as a whole. Thus, the aim of this research is to intervene both the debate concerning the current state of the laws of outer space and its possible flaws, and the debate concerning the issues and possible solutions concerning dual-use goods.

The problems within both dual-use regulation and international space law are clear, although the solutions to these issues may not be as much so. These two legal systems possibly create some strain²⁶ for many different actors: space organizations are losing possible profits as the potential in celestial bodies' resources cannot be legally exploited, tech-companies are suffering from high helium-3 prices and the heavy bureaucracy when brokering, exporting, or transferring helium-3 and products utilizing it, and solving the energy crisis is made difficult by both increasing the costs of nuclear fusion research and lowering the future possibilities for economically feasible nuclear fusion energy created utilizing helium-3. This paper was written in order to shed light on these legislative frameworks and to add another voice to the scientific discussion concerning the legal frameworks of dual-use goods and laws of outer space.

²⁵ These two systems were selected as examples since they are arguably the two most studied and largest trade regimes globally. In addition, the differences in the complexity of the two regimes allows the effective utilization of the functional comparative law method.

²⁶ See e.g. Wolf 2012, p. 1–2, 10–11.

1.3 Research method and theory background

In order to answer the research question regarding the current status of the legal framework of the laws of outer space, the method of legal dogmatism is utilized. This method is utilized by systematizing, clarifying, and interpreting the existing framework of outer space law, including treaties, customary law, relevant national legislations, and multinational agreements. In addition to this, the method is utilized from a legal historical perspective. The exploration of the historic background of outer space law is vital to effectively study its current state. The legal dogmatic method is thus utilized by examining the space operation environment of the time the outer space laws were first formed and by analyzing, how the framework has evolved until this day.²⁷

To answer the research question on how the laws of outer space should be altered in order to enable the commercial mining of helium-3 in outer space, the space resource regime is compared to other similar legal regimes. To do this, the functional legal comparative method is utilized from a *de lege ferenda*²⁸ perspective. The functional legal comparative method is used by comparing similar legal frameworks, namely the Antarctic Treaty System and the UNCLOS system, to the framework surrounding outer space resources. The results of this comparison, in addition to the legal frameworks previously systematized utilizing the legal dogmatic method, are then utilized as the basis for suggesting changes to the legal frameworks of outer space resources using a *de lege ferenda* perspective.²⁹

Regarding the research question concerning the current status of the legal framework surrounding helium-3 as a dual-use item, the method of legal dogmatism is used. The legal dogmatic method is utilized in answering this research question since, in order to understand how helium-3 is regulated around the globe, one must interpret and systematize the substance of existing laws surrounding it. The method is used by demystifying, interpreting, and clarifying the legal frameworks that surround dual-use goods, especially by analyzing the current status of and the relations between soft law instruments, such as voluntary multinational agreements, and hard law instruments, namely dual-use regulations of the U.S. and the EU.³⁰

²⁷ See e.g. Aarnio 2011, p. 104–105, 109.

²⁸ Tieteen termipankki 22.5.2020.

²⁹ See e.g. Frankenberg 2016, p. 15, Husa 2015, p. 119–127.

³⁰ See e.g. Aarnio 2011, p. 104–105, 109.

When answering the research question on how the legal framework of dual-use goods should be amended, changed, or re-interpreted to enable the efficacious use of helium-3 in technological applications, one must compare the dual-use regulations of two or more regions. This is necessary since much of the exporting, brokering, and transferring of helium-3 happens cross-borders. It is thus important to determine, how varying legal frameworks differ from each other, in order to explore alternative systems, which could work as an attempt to tackle the issues caused by the resulting differing legal frameworks.³¹ In order to do this, functional comparative law method is utilized. The functional legal comparative method is used to compare dual-use regulation regimes with differing characteristics, namely the regimes in the EU and the U.S., and voluntary multinational agreements. The results of this comparison, in addition to the legal frameworks previously systematized utilizing the legal dogmatic method, are used to create suggestion for changes to the dual-use framework using a *de lege ferenda* perspective.³²

1.4 Structure

This thesis is divided into six main chapters following the IRAC method:³³ First, this research paper describes the issues regarding helium-3, both regarding the rules laid down in the laws of outer space and its status as a dual-use item. After these issues are presented, the legal frameworks of these two subjects are explored. After the legal frameworks are presented, the paper moves to a deeper analysis of the frameworks and explores how the rules set forth in these frameworks are applied in practice. After the analysis, based on the findings in this paper, the shortcomings and limitations of the frameworks are presented, accompanied by possible alternative solutions. In the last chapter of this paper, the conclusions drawn from the findings of the paper are presented, aiming to both tie together the two main topics, outer space law and the legal framework surrounding helium-3, and to answer the four main research questions presented in the introduction to this paper. Even though two somewhat different, but, by the purpose of use, intertwined topics are analyzed, these subjects will be juxtaposed and connected

³¹ The complexity of the said framework is caused by multiple different factors, including, as an example and non-exclusively, the multiple different non-binding arrangements, forums and bodies formed by collaborations between countries (e.g. Wassenaar Arrangement and the Australia Group), lengthy and technically complex legislation (e.g. Regulation (EC) No 428/2009, which is 339 pages long and is technical in nature), and the fact that when acting cross-continentially one has to familiarize themselves with multiple differing complex legislations.

³² See e.g. Frankenberg 2016, p. 15, Husa 2015, p. 119–127.

³³ See e.g. California State University Northridge “Using the I-R-A-C structure in writing exam answers”.

in the conclusions chapter, utilizing their common denominators: helium-3 and the energy crisis.

The first chapter provides the necessary background information as an introduction to the core details regarding the topic. Since helium-3 can be an unknown topic to most legal professionals, the paper also details what helium-3 is, some of its properties, and how it is utilized in the modern world. In this chapter, the legal issues related to the substance are presented alongside the research questions with which the paper aims to demystify and analyze the related legal frameworks. The first chapter will also look at the general structure of the paper.

The second chapter presents the two topics and analyses the legal frameworks that surround them. First, the legal framework surrounding helium-3 as a dual-use item is explored utilizing a legal dogmatic analysis, taking into consideration the international treaties, regional legislations, and the rules set forth by collaborations and agreements between states. A similar dogmatic analysis is applied to the laws surrounding exploiting resources in outer space and the space laws in general. When exploring the laws surrounding outer space activities, national legislations, excluding the United States' Commercial Space Launch Competitiveness Act of 2015, fall outside the scope of this research paper.

In chapter three, the first explored items are the principles regarding the subjecthood and objecthood in international law, especially regarding the subjecthood's scope concerning private actors. Chapter three then moves to discuss the relevant principles of international law regarding the resources in outer space and the legal framework of helium-3 as a dual-use item. Concerning the dual-use control framework, the principles explored arise from the right to life, stipulated in the United Nations Universal Declaration's Article 3,³⁴ and concern the duties to ensure the safety of citizens, especially from the view of nuclear non-proliferation. Next, chapter three moves to the international principles surrounding outer space activities, namely the common heritage principle and the principle of non-appropriation. In addition to these two principles, the sources principle and the duty of peaceful dispute resolution are explored.

In the fourth chapter, the application of the rules earlier described in the paper are analyzed. The main goal of chapter four is to answer the question "how". The chapter first analyzes the application of dual-use goods regulations from the point of view of under-inclusiveness and

³⁴ Article 3 stipulates: "Everyone has the right to life, liberty and security of person".

over-inclusiveness. After this, the fourth chapter moves on to discuss the application of the outer space treaties and the United States' Commercial Space Launch Competitiveness Act of 2015.

The fifth chapter discusses and explores the possibility of changes to the legal frameworks currently in force regarding helium-3. In this chapter, the current systems, possible alternative systems, and possible amendments or additions to the existing frameworks are explored.

The sixth and final chapter draws together the conclusions reached while conducting this research and answers the research questions presented at the beginning of this paper. In addition to this, the final chapter attempts to tie down the two legal systems, that of dual-use goods and international space law, using the commonalities the two share in regards to helium-3. This chapter attempts to tie the conclusions of this paper to the energy crisis by analyzing helium-3's potential as a clean energy source, the legal and economic issues that the usage of helium-3 is currently struggling with, and finally, what possibilities there are to eliminate the issues presented and what could be potentially achieved by eliminating them.

2 THE LEGAL FRAMEWORKS SURROUNDING HELIUM-3

2.1 Helium-3's status as a dual-use item

2.1.1 General overview of the dual-use regimes

Export control is one of the strongest inter (and intra) governmental mechanisms against nuclear proliferation. The exact means by which some of these mechanisms have been executed, however, have been the source of controversy. Weighing national security against the free movement of certain dual-use goods is a difficult task to say the least. Helium-3 as the possible solution to the world's energy crisis is a great example of such an issue – whatever may bring the world closer to nuclear annihilation should be avoided at all costs. But is the current system as is the most efficient in doing so? Having too strict export control mechanisms is damaging to national economies and the businesses within them. Since helium-3 has been classified as a dual-use item, controlling its exports too strictly makes acquiring the substance heavily

bureaucratic³⁵ and thus makes it more difficult to obtain, especially from outside one's own country's borders. This, in turn, makes the research for an effective nuclear fusion method more difficult. Next, the different dual-use item control frameworks are explored.

There is a multitude of different rules and regulations in place governing the use of dual-use goods, differing from region to region³⁶ and on a national level. This in itself creates an issue: if one wants to export dual-use goods globally, the dual-use criteria for both the exporting and receiving state needs to be considered, in addition to the lists of potentially dangerous end-use destinations. This in turn means a lot of paperwork, potentially numerous licenses to apply for, and requires a vast amount of knowledge. Many companies, including those utilizing helium-3, simply do not have the knowledge required to have a clear understanding of the dual-use regulations that surround their company's actions. This is true especially when working cross-borders and cross-continently, where one has to consider multiple different criteria set forth by the differing regional and national legal frameworks.

In addition to the regional and national frameworks of dual-use controls, there are multiple different regimes setting forth rules and guidelines concerning dual-use controls. These regimes include, in addition to the dual-use control laws of the EU³⁷ and the US³⁸, the rules set forth by the Wassenaar Arrangement³⁹, Australia Group⁴⁰, Nuclear Supporters Group (NSG)⁴¹, Missile Technology Control Regime (MTCR)⁴², the Zangger Committee⁴³, and the Treaty on the Non-Proliferation of Nuclear Weapons. Let us first explore the dual-use regimes of the multinational voluntary agreements and then move to the frameworks in the EU and in the U.S.

³⁵ This matter is looked more deeply into both in this chapter and in chapter 4.1.2.

³⁶ The legal frameworks differ on multiple levels due to the multiple actors at play regarding dual-use controls. The legislative frameworks thus differ from country to country. The European Union has its own legislative framework for dual-use goods and the dual-use legislations are not harmonized between all EU member states. In addition to this, the multiple different non-binding arrangements, forums, and bodies formed by collaborations between countries (e.g. Wassenaar Arrangement and the Australia Group) create (often non-binding) rules for the signatory parties.

³⁷ Regulation (EC) No 428/2009.

³⁸ International Traffic in Arms Regulations (ITAR), namely the United States Munitions List (USML), and the Arms Export Control Act (AECA); and Export Administration Regulations (EAR).

³⁹ WA-List (19) 1, including the Munitions list and List of Dual-Use Goods Technologies; and Guidelines & Procedures, including the Initial Elements.

⁴⁰ Guidelines for Transfers of Sensitive Chemical or Biological Items and Australia Group Common Control Lists.

⁴¹ NSG guidelines, INFCIRC/254/Rev.11/Part 1 and INFCIRC/254/Rev.11/Part 2.

⁴² MTCR Guidelines, MTCR Annex (MTCR/TEM/2019/Annex 11th October 2019).

⁴³ Zangger Committee Basic document (INFCIRC/209/Rev.5).

2.1.2 Voluntary multinational agreements

One of the most notable voluntary multinational arrangements in the field of dual-use goods is the Wassenaar Arrangement. The 1996 document “Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies: Initial Elements” outlines the purpose of the Wassenaar Arrangement. In its 1st and 2nd articles, the purpose of the Arrangement is laid out in the following wording:

“The Wassenaar Arrangement has been established in order to contribute to regional and international security and stability, by promoting transparency and greater responsibility in transfers of conventional arms and dual-use goods and technologies, thus preventing destabilizing accumulations. Participating States will seek, through their national policies, to ensure that transfers of these items do not contribute to the development or enhancement of military capabilities which undermine these goals, and are not diverted to support such capabilities.

It will complement and reinforce, without duplication, the existing control regimes for weapons of mass destruction and their delivery systems, as well as other internationally recognised measures designed to promote transparency and greater responsibility, by focusing on the threats to international and regional peace and security which may arise from transfers of armaments and sensitive dual-use goods and technologies where the risks are judged greatest.”

There are a few requirements for a country to be accepted to join the Arrangement. First and foremost, the country needs to be a producer or an exporter of dual-use industrial equipment or arms. Secondly, the country has to adhere to non-proliferation policies and other national policies stipulated in non-proliferation regimes and treaties. Thirdly, the applying country must have fully effective export controls in place.⁴⁴

The Wassenaar Arrangement is a legally non-binding soft law instrument. It is not an intergovernmental organization, but rather an international arrangement made between certain states. The rules of the Wassenaar Arrangement are hence by nature non-binding, and instead, to gain binding force, they need to be separately implemented into national legislations. Due to this, the control mechanisms of the Wassenaar Arrangement do not rise from the arrangement itself, but rather from the states that have implemented the rules into their national legislations. The Wassenaar Arrangement is not a genuine international organization, and Wassenaar Arrangement’s members have not agreed to any binding obligations under international law.

⁴⁴ Wassenaar Arrangement, Initial Elements 1996, Appendix 4.

The export controls carried out in the Arrangement's framework have to be considered as purely national measures. Furthermore, Wassenaar Arrangement's decisions are not legally binding. By joining the Arrangement, the members of the Arrangement have not agreed upon any binding obligations under international law.⁴⁵

The signatory parties enjoy full sovereignty under international law to decide upon granting national export licenses without the Arrangement restricting their sovereignty. The Wassenaar Arrangement is used nationally in some countries in restricting the domestic exporting of certain goods. There are, however, national differences in the implementation and enforcement of the rules. The differing levels of national implementation may even cause forum hopping, meaning exporters moving their headquarters either physically or on paper to a location with less strict export controls to benefit from their more favorable dual-use control regulations.⁴⁶ Some Wassenaar Arrangement's members might even have looser rules than the Wassenaar Arrangement sets in place. This is largely caused by the rules of Wassenaar Arrangement being non-binding.⁴⁷

One of the most vital functions and arguably the biggest incentive for a state to join the Wassenaar Arrangement are its information exchange mechanisms. The members of the Arrangement exchange information on arms and dual-use goods and technologies, although the nature of the information exchange is voluntary.⁴⁸ This system effectively allows member states to warn other states of potentially dangerous exports and end-destinations. Regarding helium-3, for instance, a member state could warn other member states that a certain country is attempting to acquire helium-3 in order to build coolers for tritium facilities required for the manufacturing of nuclear weapons. This hopefully ends the exporting of helium-3 to such destinations from all member states. In this information exchange the transfers, denials of transfers to certain locations, and data and statistics of national exports are exchanged between the signatory parties. The voluntary nature of the notification system leads to the notification not raising a mandatory obligation to deny any similar transfers, and since there is no real "no-

⁴⁵ Eeckhout – Govaere 1992, p. 956.

⁴⁶ See e.g. Cryptography and Liberty 1999. Even though this article is now relatively dated it has aged well and is still relevant today, as the differences between national legislation of dual-use goods is still very much present.

⁴⁷ See e.g. Baker – Hurst 1998, p. 76.

⁴⁸ Wassenaar Arrangement, Initial elements 1996, IV.

undercut” principle⁴⁹ present in the Arrangement, this issue is hard to circumvent. These issues are looked more deeply into in chapter 3.2.⁵⁰

There are multiple other voluntary arrangements, concerning dual-use goods and weapons of mass destruction, that an increasing number of states keep taking part in. There is the Australia Group for dual-use items relevant to chemical and biological weapons, Nuclear Suppliers Group for items in the nuclear sector, Missile Technology Control Regime, the Hague Code of Conduct against the Proliferation of Ballistic Missiles (HCoC), and the Zangger Committee.⁵¹

The Zangger Committee, which commenced in 1971, supports the commitment to non-proliferation. The Zangger committee’s mission is to define the nature of the items and goods which would trigger the non-proliferation treaty’s requirements for safeguards set forth by the International Atomic Energy Agency (IAEA). The Zangger committee’s discussions sprouted the so-called “trigger list”, which was published in 1974. The list contains items in Article III of the non-proliferation treaty, which stipulates: “source or special fissionable material, or equipment or material especially designed or prepared for the processing, use or production of special fissionable material, to any non-nuclear-weapon State for peaceful purposes, unless the source or special fissionable material shall be subject to the safeguards required by this Article”. The Zangger committee mostly covers the exports of materials and equipment. A second support pillar towards the goal of non-proliferation, the Nuclear Suppliers Group, focuses more on the technology, production, use, and development of the items on the Zangger Agreement’s trigger list.⁵²

The NSG sets guidelines in place concerning nuclear-related exports and nuclear weapons. It was formed in 1975 after India conducted a nuclear weapon test as the first state that did not have a permanent seat in the UN Security Council. The NSG’s aim was to ensure that transfers of the items on the trigger list intended for peaceful uses would not end up in the hands of entities planning on using them for nuclear fuel generation without safeguards set in place or worse – in the creation of nuclear weapons. After the first guidelines set in place in 1978, the NSG extended its guidelines in 1992 to also include other nuclear-related exports of dual-use

⁴⁹ MTCR, for example, defines the “no-undercut” principle on their website’s frequently asked questions section as follows: “Partners are bound by a “no-undercut” policy to consult each other before considering exporting an item on the list that has been notified as denied by another Partner pursuant to the MTCR Guidelines”.

⁵⁰ Baker – Hurst 1998, p. 76.

⁵¹ See e.g. Black-Branch – Fleck 2014, p. 11.

⁵² *Id.*, p. 37–38.

technology and dual-use items, which also have uses beyond the creation of nuclear energy and nuclear weaponry.⁵³ In 1994 the NSG further amended its guidelines by adopting the so-called *non-proliferation principle*. The non-proliferation principle states, that a supplier of a product with potential capabilities of being used in nuclear proliferation, may only authorize a transfer of the said item if it is positive that the exported item would not be used for the proliferation of nuclear weapons. The objective of the NSG was to ensure that nuclear transfers for peaceful purposes would not be accidentally delivered to end-users utilizing the materials in order to conduct nuclear fuel generation without proper safeguards or in activities concerning nuclear explosives. There is no formal basis for the NSG or the Zangger Committee, and thus the guidelines are left in the hands of national implementation and voluntary adherence.⁵⁴

The Missile Technology Control Regime (MTCR) is another voluntary arrangement governing the exporting of potentially dangerous materials. The MTCR's aim is to further the non-proliferation of rockets and unmanned delivery systems. The states participating in the Regime adhere to a list of controlled items listed in the Regime's common export control policy and export control guidelines.⁵⁵

The HCoC has a fairly similar aim as the MTCR, as it aims to further the non-proliferation of ballistic missiles. HCoC's members adhere to general guidelines, which entail that the members, for instance, are to exercise maximum possible restraint in the development, testing, and deployment of Ballistic Missiles and reduce national holding of such missiles. In addition to this, the member states adhere not to assist the ballistic missile programs of states that are aiming to create WMDs.⁵⁶

These voluntary agreements all work towards the common aim of trying to prevent nuclear proliferation and thus to ensure that every person's right to life is ensured as fully as possible as stipulated in the United Nations Universal Declaration's Article 3.

2.1.3 *The legal framework of dual-use goods in the EU*

In theory, the Wassenaar Arrangement does not have a firm standing within the EU export control framework. The EU nor the EU member states do not have to comply with the rules set

⁵³ Id.

⁵⁴ Id.

⁵⁵ Id., p. 38–39.

⁵⁶ Id.

forth in the guidelines of the Arrangement. However, even though the Wassenaar Arrangements provisions are not binding, and the national legislations are not completely harmonized, the national lists of controlled items tend only to deviate slightly from the Wassenaar Arrangement's control list. In addition to this, the EU's control regime set forth in Regulation (EC) No. 428/2009 is a near copy of the Wassenaar Arrangement's control list.⁵⁷

The EU framework for dual-use goods control consists of the Regulation (EC) No. 428/2009 and the Council Joint Action 2000/401/CFSR. The "Joint Action" is an intergovernmental instrument adopted into the legislations of the EU member states alongside the provisions of the Treaty on European Union. This means that the EU export control regime is both directly applicable and unified in all of the EU member states. Notwithstanding this, the member states can still deviate from the rules of the Regulation by adopting stricter rules to protect their national security.⁵⁸

EU countries may enforce extra control on items not listed as dual-use goods when matters of public security or human rights are concerned. Sometimes extra measures may also be taken in regard to items already on the list of dual-use goods. The general rule is that dual-use items are still freely tradeable and free to be exported within the EU, but restrictions apply to actions done outside of EU borders. For some more sensitive items, described in Annex IV of Regulation (EC) No. 428/2009, the exporting, brokering, and transport are also restricted within the EU area.

In the EU, there are four different types of authorizations upholding the EU's export control regime. These are the national general export authorizations, global licenses, the EU general export authorization, and individual licenses. These export authorizations, once issued, are valid within the entire Community, sans a short objection period set for states.⁵⁹

The EU general export authorizations (EUGEAs) allow the export of certain dual-use items to specific destinations under certain conditions. The six EUGEAs currently in place are for exports after repair/replacement,⁶⁰ chemicals,⁶¹ exports to Australia, Canada, Japan, New

⁵⁷ Wassenaar Arrangement, Initial Elements 1996, IX and see e.g. WA-List (19) 1 and see Regulation (EC) No. 428/2009.

⁵⁸ Alavi – Khamichonak 2017, p. 65.

⁵⁹ See e.g. European Commission, 2018.

⁶⁰ Regulation (EC) No. 428/2009, Union general export authorisation No EU003, Annex II c.

⁶¹ Id. EU006, Annex II f.

Zealand, Norway, Switzerland, Liechtenstein, and the United States of America,⁶² exports of certain dual-use items to certain destinations,⁶³ temporary exports for exhibition or fair,⁶⁴ and telecommunications.⁶⁵ If an EUGEA is in place in a set field, the exports do not require any additional licensing procedures.⁶⁶

National general export authorizations (NGEAs) can be issued to some EU countries if they are consistent with existing EUGEAs and if they do not refer to the items that are listed in Annex II g⁶⁷ of the Regulation (EC) No. 428/2009.⁶⁸ A general authorization is directed towards all exporters of certain goods in a certain Member State. If a general authorization is given in a certain field, no additional license applications are needed – the general authorization covers the exports of all exporters in the given member state and field without any extra admission processes. The freedom of exporting granted by the NGEA is only applicable to certain states, which adhere to the relevant non-proliferation regimes and other control mechanisms of sensitive goods. These states are, as with EUGEAs, Australia, Canada, Japan, Norway, Switzerland, and the United States of America. The Commission needs to be notified if a Member state wishes to acquire a general license to a state not on this list.⁶⁹

The third type of authorization, global licenses, stipulated in Article 9 of Regulation (EC) No. 428/2009, gives exporters the freedom to conduct dual-use exporting without an additional global license and are granted by competent authorities. They can be granted to one exporter, and they cover one item or an item category. They can be granted to either single or multiple destination or end-users.⁷⁰

Individual licenses, stipulated in Article 8 of Regulation (EC) No. 428/2009, can be granted by national authorities to one exporter. They can cover exports of one or more dual-use items to one end-user or consignee in a third party. These individual authorizations need to be applied

⁶² Id. EU001, Annex II a.

⁶³ Id. EU002, Annex II b.

⁶⁴ Id. EU004, Annex II d.

⁶⁵ Id. EU005, Annex II e.

⁶⁶ See e.g. European Commission, 2018.

⁶⁷ Annex II g lists dual-use items specified in Annex I of the regulation, which despite them being in Annex I, are not covered by the general export authorisation.

⁶⁸ See e.g. European Commission, 2018.

⁶⁹ Id.

⁷⁰ Id.

and granted separately for each export by competent national authorities. For some products, however, simplified procedures are available.⁷¹

2.1.4 The legal framework of dual-use goods in the United States

There are two primary export control systems in place in the U.S. The first of these systems is the Export Administration Regulations (EAR), regulating the export of dual-use goods and the second control system is the International Traffic in Arms Regulations (ITAR), which regulates items that are manufactured solely for military purposes. The items listed in both control lists are listed firstly in the Commerce Control List (CCL), which is administered by the U.S. Department of Commerce. The second list for certain items is the Munitions List (USML), which is in turn managed by the U.S.'s State Department.⁷²

After determining which control system the item falls into, one needs to determine the item's set category within the control framework. The rules applied to the exporters are altered according to the following factors:

- 1) the exported item's classification: the more dangerous the item is deemed, the more rigid the rules surrounding it are;
- 2) its destination of shipping: the riskier the country or purchaser is deemed, the stricter the licensing requirements are;
- 3) the end-user of the given product classification and the conduct of the export.

These factors are then weighed, and depending on this weighing's results, these items are then either free of export controls, or their exports require the acquiring of a license from the Bureau of Industry and Security (BIS).

The CCL set forth in the EAR then further divides the items requiring a license into ten categories.⁷³ These ten item categories include nuclear materials, facilities and equipment, including this research paper's topic, helium-3; materials processing; chemicals, materials, microorganisms and toxins; electronics; computers, telecommunications and information security; navigation and avionics; lasers and sensors; marine; and aerospace and propulsion technologies. These items are then further split into five different categories:

⁷¹ Id.

⁷² Alavi – Khamichonak 2017, p. 67.

⁷³ Id., p. 69.

1. software;
2. equipment, assemblies, and components;
3. technology
4. test, inspection, and production equipment;
5. materials;

Each group of individual items is then given an Export Control Classification Number (ECCN) and an explanation for why the export of the items is controlled. An exporter, end-user, or manufacturer needs to first determine, after applying the item's ECCN and the Commerce Country chart to the CCL, whether their goods fall under dual-use export controls. Export control measures can be placed even on the items that do not fall within this category of controlled goods if there is a possibility that the said items would be used for either military or proliferation purposes.⁷⁴

As can be gathered from the above, the dual-use control regime in the U.S. is complex even when compared to its EU counterpart. There have been attempts to clarify and simplify this framework, but the proposed frameworks have received some critique as well.⁷⁵

The many voluntary multinational agreements, the EU dual-use regime, and the U.S. dual-use regime represent three very different legal frameworks set in place to control the exports of dual-use items. The voluntary agreements representing a soft law approach to controlling dual-use items and the EU and U.S. dual-use control regimes representing a hard law approach of differing complexities, all have their own shortcomings and critiques. By comparing these regimes and analyzing their frameworks, a better understanding on how they should be altered is gained.

2.2 Helium-3 and the laws of outer space

Space law is an area of law regulated mainly by international treaties. The majority of space law-related treaties were written around fifty years ago, fueled heavily by the fear of weaponization of the outer space followed by the space race between the United States and the Soviet Union. The race to the Moon had started to wind down as most "firsts" had been achieved, namely the Soviet Union achieving the much competed first spaceflight and Neil

⁷⁴ Alavi – Khamichonak 2017, p. 69–70.

⁷⁵ Id., p. 70–71.

Armstrong taking the first steps on the lunar surface. Such feats brought forth optimism to many – after all, they had been deemed impossible for centuries. At the same time, achieving these milestones created fears. If humans are able to launch objects into space, weapons are soon to follow. Due to this fear, heavy codification took place, and in a span of under fifteen years, space law as we know it was formed.

Now, around fifty years after space law originated, the world has changed rapidly. When the treaties governing space activities were written, the main actors in the field of space activities were nations. It was inconceivable that private organizations could ever be able to conduct space operations – it was simply too costly. At most, it was thought that those organizations would be state-run, like is the case with the National Aeronautics and Space Administration (NASA), which is an independent agency of the United States federal government, not part of any executive department.⁷⁶ Around 50 years later, many things have changed. SpaceX's entry into the scene of commercial space operations changed everything. Suddenly the price of launching a rocket fell drastically to a fraction of the former costs, largely thanks to SpaceX's new and innovative rocket boosters being reusable, topped by the fact that SpaceX managed to localize most of the manufacturing of the rocket parts, increasing their quality and lowering the costs by eliminating the necessity of shipping the products from overseas. Nowadays, it is safe to say that almost the entire space operations industry, or at least the most prominent part of it, is run by private organizations – under rules created for nations.

The rise of a plethora of private organizations has, after decades of hiatus, given wake to the discussion on the current state and the future of space law. Scholars widely agree on the current state of international space law not being able to uphold the fast pace private space organizations are developing and shaping the space industry, though the exact means of how space law should be changed is not exactly agreed upon. This debate focuses especially on the two most controversial matters: the common heritage principle and the principle of non-appropriation – the two principles which may decide whether helium-3's large-scale utilization will be financially feasible in the future.

There are multiple different sources of international law, all of which are stated in Article 38 of the Statute of the International Court of Justice, which states:

⁷⁶ See e.g. Nasa Headquarters 2020.

“1. The Court, whose function is to decide in accordance with international law such disputes as are submitted to it, shall apply:

- a. international conventions, whether general or particular, establishing rules expressly recognized by the contesting states;*
- b. international custom, as evidence of a general practice accepted as law;*
- c. the general principles of law recognized by civilized nations;*
- d. subject to the provisions of Article 59, judicial decisions and the teachings of the most highly qualified publicists of the various nations, as subsidiary means for the determination of rules of law.”*

The most important two sources of international law can be found in the first two subparagraphs: treaties and customary law. The treaties concerning outer space law are the Outer Space Treaty, the Rescue Agreement, the Liability Convention, the Registration Convention, and the Moon Agreement. Out of these five treaties concerning outer space, the most important two concerning this research paper are the Outer Space Treaty and the Moon Agreement.

Both the Moon Agreement and the Outer Space Treaty are so-called “law-making” treaties, creating general norms that govern the conducts between the signatory parties. Even the parties that do not sign these articles can, in fact, be subject to the norms. Customary law forms when there is a general practice accepted as law. However, since private actors exploiting resources in outer space is unprecedented, many argue that customary law has not been formed, and even if a new customary law concerning outer space would form and other states would follow this newly formed law by the book, the space-faring states could, by persistently objecting, make such a law non-binding on their behalf.⁷⁷ The persistent objection principle entails that if a state objects a new norm during its formation, it can exempt itself from the application of the norm. Such persistent objecting needs to be explicit and evidence that the norm has been persistently objected has to be clear. If a state remains quiet regarding the matter, the state is presumed to have accepted the norm.⁷⁸ From the surface, it might look like the argument for the lack of customary law concerning outer space activities is accurate. It is argued, however, that when international laws of outer space are concerned, customary law forms in a unique manner, creating “instant” or “accelerated” customary law. Instantaneous customary law means, as one

⁷⁷ Crawford 2012, p. 23–30.

⁷⁸ Id., p. 28.

would expect, rapid, if not instantaneous formation of international customary law. While many scholars do not welcome the instantaneous formation of customary law and whilst many states would object it, accelerated customary law is usually a more widely accepted matter. Accelerated customary law can form within a few years and it is deemed binding on states that have not persistently objected it.⁷⁹ These matters are, however, not unanimously agreed upon. Many still claim – regarding the Moon Agreement, for instance – that due to the treaty’s loud opposition and lack of wide acceptance, its norms do not fulfill the criteria of general practice accepted as law, and thus customary law has not formed.⁸⁰

Regarding the status of the Moon Agreement, Stephan Hobe in his 2016 paper “The International Institute of Space Law adopts Position Paper on Space Resource Mining” writes the following:

“Due to the very low number of ratifications and the sometimes even rather violent opposition of particular countries against some language in the Moon Agreement one can certainly not state that the economic regulation contained in the Moon Agreement has already emerged into customary international law.”⁸¹

In his footnotes, he backs this argument by referring to the International Court of Justice’s (ICJ) *North Sea Continental Shelf* case regarding the formation of customary law.⁸²

In addition to the international treaties concerning outer space, there is one special piece of national legislation that demands some attention: The U.S.’s Commercial Space Launch Competitiveness Act of 2015. This act essentially circumvented international law’s prohibition of non-appropriation in its entirety. Its Chapter 513 regarding commercial space resource exploration and utilization reads as follows:

“§ 51302. Commercial exploration and commercial recovery

The President, acting through appropriate Federal agencies, shall—

(1) facilitate commercial exploration for and commercial recovery of space resources by United States citizens;

(2) discourage government barriers to the development in the United States of economically viable, safe, and stable industries for commercial

⁷⁹ See e.g. Scharf 2014, p. 341.

⁸⁰ Hobe 2016, p.205–206 and see e.g. Crawford, 2012, p. 24–26, 31, and Gorove 1969, p. 349, 351.

⁸¹ Id.

⁸² Id.

exploration for and commercial recovery of space resources in manners consistent with the international obligations of the United States; and

(3) promote the right of United States citizens to engage in commercial exploration for and commercial recovery of space resources free from harmful interference, in accordance with the international obligations of the United States and subject to authorization and continuing supervision by the Federal Government.

§ 51303. Asteroid resource and space resource rights

A United States citizen engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States.

SEC. 403. DISCLAIMER OF EXTRATERRITORIAL SOVEREIGNTY.

It is the sense of Congress that by the enactment of this Act, the United States does not thereby assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body.”

This Act establishes three things: 1) The citizens of the United States may gather, transfer, use, or sell any gathered space resources freely; 2) By stating that the gathering of resources from space is done in manners consistent with the U.S.’s international obligations, the U.S. essentially claims that the citizens of the United States are, while gathering, transferring, selling, using or possessing space resources, not breaching the common heritage principle. This creates a new interpretation to the common heritage principle, essentially meaning that the requirement of “benefit of all mankind” is fulfilled when conducting such private actions without the necessity of sharing any of the gained profits or resources; and 3) by stating in section 403 that “the United States does not thereby assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body”, the U.S. is creating a new interpretation of the much-debated issue of non-appropriation. Essentially, when stating that by gathering space resources according to the U.S.’s international obligations, one does not own the given space object, but rather only the materials extracted from it. This Act shall be explored more deeply in chapter 4.2.2.⁸³

⁸³ Id., p. 206–207.

Treaties governing outer space activities were written over fifty years ago. At that time, it was unthinkable that a private organization could ever manage to even do a fraction of what, for instance, SpaceX, Blue Origin, and Virgin Galactic have achieved in the past decade. These three companies are not the only exceptions: nowadays, a fair proportion of all notable space ventures are conducted by private space organizations, who not only tend to conduct their operations quicker due to less bureaucracy, but also cheaper. Even though this change of balance has occurred, the international laws concerning space activities have barely changed in the past 50 years.

3 PRINCIPLES OF INTERNATIONAL LAW CONCERNING HELIUM-3

3.1 Subjects and objects of international law

When talking about non-governmental actors conducting activities in outer space, we need to look at the subjecthood and objecthood of international law. In space law, there is much debate over whether the laws of outer space govern not only the actions of states, but also the non-governmental actors operating in outer space. To better understand this topic, we shall next explore the general concepts of subjecthood and objecthood under international law.

Subjects of international law are entities that possess 1) international rights; 2) international obligations; 3) the capacity to maintain rights by bringing international claims; and 4) the capacity to be held responsible for breaches of obligation by being subjected to claims concerning these obligations. To put it short, an entity that is able to be held under customary law as capable of possessing duties and rights and which is capable of both bringing and being the subject of international claims is considered a legal person under international law. Even if the second necessity is not fulfilled, the entity can be a limited and restricted type of legal personality, which is dependent on agreements or acquiesces made by recognized legal persons.⁸⁴ There is a clear distinction between international law applicable *erga omnes*, obligations towards all, and the laws that are only applicable between the parties of the said laws. However, with the exception of the Charter of the United Nations, treaties are only binding on their parties unless the said treaty's rules become rules of general international law.⁸⁵

⁸⁴ Crawford 2012, p. 115–116.

⁸⁵ Lowder 1999, p. 258.

To effectively discuss the legal personality of non-state entities and individuals in international law, basic theories of international law concerning subjecthood need to be investigated. There are three main approaches to the legal status of non-governmental entities under international law: their status as an object, subject, or beneficiary under international law. According to classical international law doctrines, only states are the subjects of the international legal regime and they are the only entities capable of possessing the capacity to bring legal actions on international forums.⁸⁶

According to this view, non-state entities are not subjects, but rather objects of the international field, and thus individuals and non-state entities have no possibility and no legal right to bring their claims to the international forums, even if their rights have been violated.⁸⁷ Take, for example, a hypothetical scenario in which a dual-use exporter was sanctioned by the UN for the breach of the NPT when conducting their exports, and the exported goods were (potentially unlawfully) confiscated. Even if their rights were violated in the process, they would have no means to bring claims concerning the matter as an individual. These two classical international theories governing the international law field are still the two dominant states that non-state entities fall into. There is, however, a third category of status: the status of a beneficiary of international law.⁸⁸

These beneficiaries do not work as participants of the legal order, nor are they procedural subjects. In multiple cases concerning human rights, for example, treaties are created to benefit non-state actors and, more specifically, individuals.⁸⁹ While the beneficiary individuals cannot assert claims under international law, they can, however, benefit from positive law.⁹⁰

Understanding the matter of subjecthood concerning non-governmental entities is especially important for understanding the international laws of outer space and the oncoming discussion regarding the much-debated principles of common heritage and non-appropriation. This importance sprouts from the fact that the actors operating in outer space are nowadays largely non-governmental, even though most treaties are written from the perspective of states whilst non-governmental entities are rarely mentioned.

⁸⁶ Diederiks-Verschoor – Gormley 1977, p. 131.

⁸⁷ There are exceptions to this rule. In some cases states have given diplomatic protection to non-state parties. Take for example ICJ's cases *Barcelona Traction* of 1970 and *Ambatielos* of 1952.

⁸⁸ Diederiks-Verschoor – Gormley 1977, p. 131.

⁸⁹ One such example would be the Geneva Convention on the Protection of Prisoners and Civilian Populations of 1949.

⁹⁰ Diederiks-Verschoor – Gormley 1977, p. 131.

3.2 The principles of international law concerning dual-use items

Due to dual-use goods' potential to be utilized in nuclear proliferation and other uses that may pose a threat to civilians, the legislative framework surrounding these goods is built on some of the most basic principles of international law concerning the protection of human lives, wellbeing, and freedom. These principles are based on the foundation created by the UN's Universal declaration of human rights' Article 3's right to life. In addition to this, the principles concerning human rights due diligence when conducting exporting activities are important when it comes to detecting potentially malicious end-users of exports. For example, the UN's Guiding Principles on Business and Human Rights require businesses conducting exporting activities to conduct human rights due diligence before exporting certain goods. This principle, however, is formally non-binding.⁹¹ These principles create a framework on which more pinpointed laws and guidelines are built. Take, for instance, the principle of non-proliferation.

Article I of the Non-Proliferation treaty summarizes the principle of nuclear non-proliferation as follows:

“Each nuclear-weapon State Party to the Treaty undertakes not to transfer to any recipient whatsoever nuclear weapons or other nuclear explosive devices or control over such weapons or explosive devices directly, or indirectly; and not in any way to assist, encourage, or induce any non-nuclear-weapon State to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices, or control over such weapons or explosive devices.”

When discussing the NPT, it is imperative to discuss its difficult standing in the field of international law due to its nature as an exception to *sovereign equality*. The equality of sovereignties originates from the Charter of the United Nations Article 2, stating that the United Nations is based on the principle of the sovereign equality of all the members of the UN.

However, in the light of the equality of sovereignties principle, the NPT creates something called the *nuclear inequality*. In his book “Power in the Global Information Age”, Joseph S. Nye, one of the more influential international relations scholars, encapsulates the NPT's special standing well:

“In the abstract, however, it is quite possible to justify nuclear inequality. Imagine that an international security conference convened without publicity

⁹¹ Office of the High Commissioner for Human Rights 2011, p. 15–18.

and that the diplomats did not know in advance which countries they would represent. If they knew nothing of world politics today or of the probable consequences of acquiring nuclear weapons, they might reason that if sovereign states have an equal right to self-defense, then either all or none should have nuclear weapons. But if they were informed that, in current circumstances, the efforts to create either of these two conditions might significantly increase the risk of nuclear war, they may well, under certain conditions, accept nuclear inequality.”⁹²

As UN member states should have an equal right to self-defense, if the principle of sovereign equality was followed, nuclear weapons should be either available for everyone or optionally for no one. Such an approach was, however, not taken. An unequal system was created: the states with nuclear weapons got to keep their weapons and the states with no nuclear weapons were left empty-handed, having been denied the right to acquire nuclear weapons.

“The [NPT] creates two categories of states: five of that are recognized as nuclear weapons states and the rest which promise not to follow suit.”⁹³

The NPT thus has a unique standing within the framework of international law. Though the treaty has been criticized, especially regarding its lack of effectiveness⁹⁴ and it not being sustainable in a longer time frame due to its discriminatory nature,⁹⁵ it is still the staple legal instrument when it comes to preventing nuclear proliferation. The NPT, however, only lays the foundation, which the legal frameworks surrounding dual-use goods are built on. On this foundation, many important mechanisms of assessing exports and information sharing have been built. These mechanisms can be found in regimes such as the aforementioned Wassenaar Arrangement.

There are a few main principles and mechanisms repeated across most different dual-use control regimes used to assess export requests and sharing information regarding non-proliferation: The *no-undercut* principle and *catch-all clause*. The *no-undercut principle* includes provisions to prevent the exporting of certain goods to a certain actor or country to which another state has denied a certain export, due to their assessment of that actor’s or country’s level of potential danger. The state denying such an export would have to notify other countries subject to the *no-undercut* principle, after which they should consider whether the reasoning given is enough for

⁹² Nye 2004, p. 145–146.

⁹³ Id., p. 146–148.

⁹⁴ See e.g. Kluth 18.6.2020.

⁹⁵ See e.g. Nye 2004, p. 145–146.

them to also deny the exporting to the said end-destination. This procedure is set in place in order for countries to increase their willingness and incentives to share information on dual-use restrictions.⁹⁶ As mentioned earlier, there is no true no-undercut principle in place in the Wassenaar Arrangement.

Another mechanism to prevent exporting to potentially dangerous locations is the *catch-all clause*. The *catch-all clause* is a mechanism used in multiple different export control regimes, including Regulation (EC) No 428/2009, using which states may block any exports to destinations that are suspected of using the shipments as a part of their nuclear weapons program. This can be done even if such an item would not appear on the export control lists. The catch-all clause enables countries to individually broaden the scope of the lists restricting dual-use items for nations and other actors that they deem dangerous. An example of the *catch-all clause* can be found in EU's Regulation (EC) No 428/2009 chapter II's Articles 3 and 4 regarding the scope of application, reading as follows:

“An authorisation shall be required for the export of the dual-use items listed in Annex I. - - an authorisation may also be required for the export to all or certain destinations of certain dual-use items not listed in Annex I.”

The *catch-all clause* is set in place to counter the issue regarding the gap between the slow pace of adopting new regulations and amending the existing regulations, and fast-paced technological development. This provision allows states to deny the exporting of certain goods without any forewarning or existing control of a said item. The *catch-all clause* thus brings some uncertainty for the exporters of potential dual-use goods and businesses depending on these products. This is especially true concerning actors dealing with items that can be potentially dangerous but are not labeled as dual-use goods. One good example of such a product would be helium-3 refrigerators. In both the regulation of the EU and the U.S., helium-3 refrigerators are listed as a dual-use item in the following wording:

“Tritium facilities or plants, and equipment therefor, as follows: - - helium refrigeration units capable of cooling to 23 K (– 250 °C) or less, with heat removal capacity greater than 150 W”

This does not directly apply to the helium-3 refrigerators that are not used in tritium facilities or plants but rather in, for instance, the cooling of quantum computer chips. However, essentially the same technology is used in the tritium facilities. This means that states may deny

⁹⁶ See e.g. Bureau of Industry and Security, 2020.

the export of such items to certain legitimate buyers without the item ever being on the list of controlled items. This creates vast uncertainty for operators acting in these kinds of fields. The fact that the *catch-all clause* brings more flexibility to national authorities can be considered a positive aspect of the mechanism, especially since this flexibility may end up “catching” a potentially dangerous export before it is added to the export control lists.

There is, however, an issue concerning the non-bindingness of the *catch-all clause* reports. Taking as an example Regulation (EC) No 428/2009 Chapter II’s Article 3, the members partaking in this system are not obliged to decline their exports to a certain end-user or of certain dual-use goods notified by a member as potentially dangerous, causing a gap in the *catch-all clause*’s mechanism.⁹⁷

3.3 The principles of international law concerning outer space resource exploitation

The most important principles of international space law are laid out in the Outer Space treaty. Out of these principles namely the principle of freedom of exploration and use of outer space and celestial bodies and the principle of non-appropriation apply to mining resources on the Moon and other celestial bodies. The former consists of two parts laid down in Article I of the Outer space treaty, which states:

“The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.

Outer space, including the moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies”⁹⁸

The second principle is the principle of non-appropriation, which can be found from Article II of the Outer Space treaty:

“Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means”⁹⁹

⁹⁷ See e.g. European Commission 28.5.2018.

⁹⁸ See e.g. Zhukov – Kolosov 2014, p. 44–48.

⁹⁹ Id., p. 48–50.

Article III lays down a third rule to be followed when conducting space activities, namely the requirement to act in accordance with international law when conducting space activities:

*“The activities of States in the exploration and use of outer space shall be carried on in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international co-operation and understanding.”*¹⁰⁰

The rules and principles of international law, as stated in the Outer Space Treaty, also apply to conducts taking place in outer space. However, there are limits to this extension, as Gennady Zhukov and Yuri Kolosov put well in their book “International space law”:

“It would, in our opinion, be wrong to interpret this principle as mechanically extending to the space activities of states certain branches of international law, such as the law of the sea or the law of the air. The Space Treaty in this case refers, rather, to the general principles of international law, which states have to be guided by, irrespective of where or in what connection they enter into relations with one another, which includes the relations that arise between them in exploring and using outer space. Since the Space Treaty became effective it has been customary to speak of the existence of international space law as a new and independent branch of general international law. This independence is, however, relative and ought not be treated as absolute. The specific principles and rules of international space law have to be (and are) in harmony with the generally accepted fundamental principles of international law ... Observing the general principles of international law, including the principles of the UN Charter, in space as well as on Earth, is crucial in determining whether the great scientific and technical advances of our times connected with space exploration will be used for the benefit and in the interest of all countries or whether, on the contrary, they will bring mankind supreme misery.”

It has been argued that, for instance, laws regarding the peaceful use of outer space can be derived from international treaties. It is, for example, nearly unanimously agreed that the principles concerning the maintenance of peace apply in full force concerning activities conducted in outer space. The principle of peaceful settlement of international disputes arising from the UN Charter’s Article 2(3)-(4) is a good example of a principle directly applied to outer space activities. The principle aims to ensure that no force is used when addressing international disputes between individual states by making such actions impermissible.¹⁰¹

¹⁰⁰ Id., p. 54–55.

¹⁰¹ Crawford 2012, p. 718.

4 THE APPLICATION OF THE LEGISLATION SURROUNDING HELIUM-3

4.1 Application of dual-use goods regulations

4.1.1 *The dangers of under-inclusiveness and the legality of nuclear weapons*

The dangers of dual-use legislation's under-inclusiveness are apparent: dual-use products are carefully regulated because they can pose a threat to human lives, health, and freedom, and since they can contribute to conflicts, threats to peace, and threats to security. If the scope of the dual-use legislation is set too low, the possibility for the threats to actualize grows. Therefore there is an obvious incentive to regulate dual-use goods as strictly as possible. However, it seems like the right balance has not yet been found. As most can agree, out of the two issues at hand, the issue of under-inclusiveness and the issue of over-inclusiveness, the latter is the safer issue to have.

The regulatory framework surrounding dual-use goods, however complex it may be, is vital for ensuring the non-proliferation of nuclear weapons and thus for effectively ensuring that the UN's Universal declaration of human rights' Article 3's right to life is fulfilled as effectively as possible.

As stated earlier, arguably the most vital aim of the dual-use regime is the prevention of nuclear proliferation. Nuclear weapons have been a long-debated issue. Concerning this debate, one of the most significant cases concerning the usage of nuclear weapons, ECJ's Nuclear Weapons Case of 1996 (Legality of the Threat or Use of Nuclear Weapons (Advisory Opinion)), must be discussed. In this case, the ICJ's majority opinion did not find either the use, threat to use, or the possession of nuclear weapons to be in breach of international law.¹⁰²

However, as stated by Grant Niemann:

“There is no credible case that can be made for the possession, use or threat of use of nuclear weapons. While some skilled in rhetoric may be able to mount an argument in favour of their legality, it is hard to see how these arguments can stand the test of genuine scrutiny.” The indiscriminate nature of these weapons, which not only affect the persons targeted but can have

¹⁰² ICJ 1996, Rep 326 and Niemann 2013, p. 193.

'lingering after effects' such as cancer, genetic mutation and environmental destruction on scores of humans well away from the bomb site and which may even seriously damage the human gene pool, clearly show that anyone who used these weapons would (on today's standards) very likely commit a Crime Against Humanity or even Genocide. The collateral damage associated with the potential failure of the world's food crops in the event of a nuclear winter would on its own suggest a level of criminality far exceeding the worst excesses ever experienced by humanity thus far.⁴ Anyone contemplating the use of these weapons could not plead ignorance of these likely outcomes in an attempt to escape criminal liability because, as noted by the ICJ in the Nuclear Weapons Case''¹⁰³

The detonation of one modern nuclear weapon can generate more destruction-capable energy than has been utilized by any conventional weapons used in all the wars fought to this day throughout history.¹⁰⁴ And still, what is remarkable in the *Nuclear Weapons Case*, is that the ICJ's majority opinion did not find either the use, threat to use, or the possession of nuclear weapons to be in breach of international law per se under certain circumstances. However, as Niemann construes: "the circumstances of how and when they could be used in accordance with international humanitarian law, is so artificial and contrived, that the minority decision, especially that of Judge Weeramantry is the more credible assessment of the law and is relied on in the article as the correct statement of the law."¹⁰⁵

As is stated in ICJ's *Nuclear Weapons Case*, threatening to use force conflicts with basic principles of international humanitarian law. This is due to multiple reasons: the usage of nuclear weapons is against the principles of distinction, the principle of proportionality, the principle of the prohibition of the employment of poisonous weapons, the principle of prohibiting the disproportionate destruction of nature and the environment, the principle of humanity, and the principle of preserving hospitals, objects of cultural significance and locations used in religious worship.¹⁰⁶

Even if the use of nuclear weapons is not deemed to be against international law in every circumstance per se, the principles laid down in the NPT have thus far been observed to have been to some extent effective, though the pace of fulfilling the goal of dismantling nuclear weapons is slower than initially planned. As the signatory parties to the NPT are slowly but steadily dismantling their nuclear weaponry, the number of active nuclear weapons is

¹⁰³ Niemann 2013, p. 191–192.

¹⁰⁴ Id., ICJ 1996, Rep 231.

¹⁰⁵ Id., p. 193.

¹⁰⁶ Id., p. 194, ICJ 1996, Rep 275, and see e.g. International Committee of the Red Cross 18.9.2015.

decreasing globally as time passes.¹⁰⁷ The problematic entities are not the signatory parties of the NPT but rather the states that have refrained from signing the treaty. These states obtaining nuclear weapons disturbs the entire balance which is attempted to obtain with the NPT: if all signatory parties dismantle their nuclear weaponry and the non-signatory parties obtain materials to create their own nuclear weapons, the balance of power shifts and the risk of potential nuclear conflict increases. This is why controlling exports to potentially dangerous states is of utmost importance.

It is thus apparent why the under-inclusiveness of the export control regimes is potentially very dangerous. The export control regimes are set in place for one purpose: to protect human lives, health, and freedom. The less inclusive the dual-use control regulations are and the less they are abided, the more of a chance there is for dual-use goods to end up to end-users with potential malicious intentions of use.

Another large issue in dual-use regimes is the lack of end-user verification. End-use verification entails conducting end-use due-diligence and thus making sure that the exported goods do not end up being used for prohibited military purposes or nuclear proliferation. A material in and of itself might not be dangerous – fertilizers, for example, are usually meant to be used for farming purposes. The phosphate in the fertilizers can, however, be used in the creation of nuclear weaponry. Thus determining whether one is exporting their goods to a farm or to an undercover nuclear enrichment plant is of utmost importance.¹⁰⁸ Even if there are end-user licenses in place, it is difficult, if not impossible, to monitor where all the exported goods end up being used; especially concerning the probability of the thought end-user reselling and re-exporting said goods further to another user, that is conducting potentially dangerous activities such as nuclear proliferation.¹⁰⁹ This issue presents yet another reason why under-inclusiveness can be detrimental, especially when concerning information-sharing. If no proper and effective information-sharing mechanisms are set in place, many seemingly common but still potentially dangerous exports may remain undetected for longer and thus end in the hands of potentially malicious end-users.

¹⁰⁷ The matter of nuclear weapon dismantling is highly complex. Whereas some reports indicate that the number of nuclear weapons is globally decreasing (see e.g. Stockholm International Peace Research Institute Yearbook 2020), others argue that the decrease is due to nuclear states dismantling their obsolescent warheads while they are modernizing their other warheads (see e.g. Kluth 18.6.2020). This debate, however, falls outside the scope of this research paper.

¹⁰⁸ See e.g. Kelley – Fedchenko 2017, p. 2, 12.

¹⁰⁹ See e.g. Lloyd 2004, p. 330.

4.1.2 *The harm of over-inclusiveness*

The export restricting mechanisms bear weight on the actors of national economies. Restricting the export of sensitive items is especially burdensome on smaller companies, mostly in the field of high-tech, that do not have the time, resources, or knowledge to cope with the jungle of bureaucracy caused by the many-step processes of qualifying as either an exporter or a safe purchaser. At the lowest level, regardless of the legislation in place, the exporters must be aware of the lists containing the controlled sensitive items. This requires a lot of knowledge about the market and setting up complicated compliance programs, which many smaller companies lack altogether. In addition, even if the exporters were to familiarize themselves with the control lists, it is not always self-explanatory whether the control list's items and definitions in reality apply to one's products. Large corporations may have the means, resources, time, and skill to both afford such programs and they may be able to compete in a market with an enormous amount of bureaucracy. Smaller companies, however, usually operate completely in the dark without knowing what dual-use goods are, let alone that with them comes a plethora of regulations to comply with. This issue is yet again magnified since certain high-tech goods are often manufactured only in a handful of locations in the world, including helium-3. This will understandably lead to more cross-border transactions. Since the dual-use goods control mechanisms are different in both the EU, USA, and in the rest of the world, the exporters and purchasers need to be aware and comply with the systems of both sides of the transaction. Thus, in order to act globally, an exporter has to be aware of multiple different legislative regimes concerning dual-use goods.¹¹⁰

As is the case in the U.S. regulation, in addition to the items listed in Regulation (EC) No. 428/2009, the EU countries may also enforce extra control on items not listed as dual-use items by utilizing the *catch-all clause*. This may be done when matters of public security or human rights are concerned. Sometimes extra measures may also be taken regarding items already listed as dual-use goods. This provision may lead to states denying the exporting of a certain item even though it is currently not within the dual-use control lists, which creates uncertainty for the exporters of potential dual-use goods and businesses depending on these products. The general rule is that dual-use items are still freely tradeable and free to be exported within the EU, but restrictions apply to actions outside the EU borders. For some more sensitive items,

¹¹⁰ Alavi – Khamichonak 2017, p. 70–72.

described in Annex IV of Regulation (EC) No. 428/2009, the exporting, brokering, and transport are also restricted within the EU area.

The dual-use regime, especially in the United States, appears to be excessively overarching, hindering its effectiveness. The items subject to classification are defined too broadly, overburdening the system with items that could be left out of the regulation entirely. A second issue concerning the regulation sounds conversely like a positive aspect: the constant updating and development of the dual-use regimes. However, as more and more items get added to the control lists, the lengthier and more complex the dual-use regimes become. Solely the procedural, monetary, resource, time, and manpower costs of upholding these kinds of systems are immense.¹¹¹

Creating an efficient and yet safe export control system is immensely difficult. It is a constant search of balance and mitigating between the interests of national economies and, on the contrary, that of national (and global) security. It is speculated that having dual-use control mechanisms in place creates a net loss for countries. This is, however, hard to calculate – putting a price on safety and security is difficult, especially when the realization of these dangers could prove very costly, both financially speaking and concerning the potential loss of lives.¹¹²

4.2 How the laws of outer space restrict acquiring helium-3

4.2.1 The common heritage principle and the principle of non-appropriation

There are multiple different definitions for the common heritage of all mankind. It could, for instance, be described as something belonging to all of humankind and which should be aimed to be protected for generations to come.¹¹³ Due to the nature of the principle, it mainly protects the less developed and industrialized nations since the areas of common heritage are ones that they do not typically have access to. The principle protects these common heritage areas from being made unavailable for these nations – possibly permanently. Some scholars say, however, that these regimes will inherently change as the resources on our planet become more and more scarce.¹¹⁴

¹¹¹ Id.

¹¹² Id. and see e.g. Bonarriva – Koscielski – Wilson 2009 for a more detailed explanation on the economic effects of export controls.

¹¹³ Shackelford 2009, p. 109–111.

¹¹⁴ Skauge 2020, p. 817.

Like the High Seas and Antarctica, Outer space is considered *res communis*, common heritage, or global commons. This concept differs from *res nullius*, in which the property, item, or area in question is ownerless but is free to be acquired. This common heritage of mankind principle can be found incorporated from the Moon Agreement's Article 11, the United Nations Conventions on the Law of the Sea, and the Antarctic Treaty System.¹¹⁵

Since there is no specific reference to space mining in articles I and II of the OST, the questions regarding Outer Space's state as a global common and how the articles stipulating the common heritage principle concerning space mining should be interpreted in the framework of the Moon Agreement and the OST are left unclear.¹¹⁶

One of the reasons the Moon Agreement is only signed by so few states lies in the Moon Agreement's Article 11(1) and Article 11(7d), stipulating the principle of common heritage of all mankind:

“The moon and its natural resources are the common heritage of mankind”

“The main purposes of the international regime to be established shall include: - - An equitable sharing by all States Parties in the benefits derived from those resources, whereby the interests and needs of the developing countries, as well as the efforts of those countries which have contributed either directly or indirectly to the exploration of the moon, shall be given special consideration.”

The way the common heritage principle is laid out in Article 11 of the Moon Agreement left states in the unknown regarding the specific kind of sharing this principle entails. What was left unclear was whether the sharing required was so-called *real sharing*, meaning that the benefits of the exploitation and mining of space resources were to be shared, or whether this principle's core meaning was more of a regime, controlling the exploitation to be conducted in a manner which would ensure that all states get a fair chance of reaping the benefits of outer space resources through, for example, means like technology sharing, joint space operations, and ensuring that the celestial bodies are not rendered unusable for future use through inconsiderate mining actions.¹¹⁷

¹¹⁵ Froehlich 2017, p. 278–279.

¹¹⁶ Von der Dunk 2017, p. 91–93.

¹¹⁷ Froehlich 2017, p. 279.

The debate regarding outer space law's common heritage principle is not new to the field of international law. In the 1980s, a similar issue was debated regarding the mining of deep seabed resources. UNCLOS article 136 and 137 expressively stipulate:

“Article 136

Common heritage of mankind

The Area¹¹⁸ and its resources are the common heritage of mankind.

Article 137

Legal status of the Area and its resources

1. No State shall claim or exercise sovereignty or sovereign rights over any part of the Area or its resources, nor shall any State or natural or juridical person appropriate any part thereof. No such claim or exercise of sovereignty or sovereign rights nor such appropriation shall be recognized.

2. All rights in the resources of the Area are vested in mankind as a whole, on whose behalf the Authority shall act. These resources are not subject to alienation. The minerals recovered from the Area, however, may only be alienated in accordance with this Part and the rules, regulations and procedures of the Authority.

3. No State or natural or juridical person shall claim, acquire or exercise rights with respect to the minerals recovered from the Area except in accordance with this Part. Otherwise, no such claim, acquisition or exercise of such rights shall be recognized.”

Two stances were taken regarding this issue: the states with capabilities of acquiring these resources opted for the freedom to acquire the deep seabed resources, whereas the states with no capabilities opted for these resources to be the property of all mankind. Hence, the positions are strikingly similar to that of outer space law: the states with no space-faring capabilities wish for space resources to remain as the property of all mankind, whereas the states with space-faring capabilities wish for the resources to be free for taking.¹¹⁹

Article 137 of UNCLOS expressively states that all mineral resources shall be “vested [with] mankind as a whole”. This provision was interpreted in two different main schools of thought. The technologically more advanced states argued that the state extracting the said resource from the deep seabed should have an exclusive right to that resource and its profits, while the less

¹¹⁸ UNCLOS article 1: "Area" means the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction.

¹¹⁹ Coffey 2009, p. 129–133.

developed countries with no capabilities to acquire resources from the deep seabed vouched for a model in which the deep seabed resources should be equally divided with all states pleading to the Common Heritage principle.¹²⁰ When the UNCLOS was first implemented, the International Seabed Authority (ISA) ensured that mining technology and profits were to be distributed to the treaty's less developed parties.

After much debate and multiple compromises, UNCLOS's issue was resolved arguably in the favor of the more technologically advanced nations, and in 1994 it was decided that the deep seabed resources would be managed in a "more market-oriented manner".¹²¹ The Common Heritage requirement in the UNCLOS is resolved by the ISA requiring any private or government entity that applies for a permit to exploit deep seabed resources to pay a fee of \$500,000 in addition to an annual fee of \$1,000,000.¹²² In addition to this, a technology sharing requirement was initially in place, requiring the members conducting deep seabed resource activities to share their mining technology with the less developed nations. This technology sharing requirement has thus been removed due to loud opposition especially from the U.S.¹²³

The U.S. was, however, not satisfied with UNCLOS. They believed that customary law provided enough protection and governance, and not unlike the Moon Agreement, considered the deep-sea mining provisions of the UNCLOS and the ISA alike to be "irreconcilable with free-market principles.", making the UNCLOS obsolete on their part.¹²⁴

Around thirty-five years prior to the U.S. Commercial Space Launch Competitiveness Act of 2015, a fairly similar Act was passed. U.S.' dissatisfaction with the UNCLOS system led to the U.S. adopting the Deep Seabed Hard Mineral Resources Act (Seabed Act) of 1980.¹²⁵ This Act is in many ways like the Commercial Space Launch competitiveness act: like the aforementioned act concerning space activities, § 1401 of the Act allows U.S citizens and companies the exploration and commercial recovery of hard minerals from the seabed until an international treaty acceptable to the United States was created. The Seabed Act is fairly exhaustive, and its most important provisions are arguably the ones stipulating the right to recover hard mineral resources, and to own, transport, use, and sell hard mineral resources

¹²⁰ Id., p. 129.

¹²¹ See e.g. Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea.

¹²² International Seabed Authority, 2002, p. 58.

¹²³ See e.g. Mirasola 15.3.2015.

¹²⁴ Skauge 2020, p.817 and see e.g. Richardson, 30.7.1994, and The Heritage Foundation, 14.7.2011.

¹²⁵ See e.g. The Heritage Foundation, 14.7.2011.

recovered stipulated in the Act's article 1412 (b)(3). This essentially means that these provisions grant United States' citizens the property rights to minerals they extract from deep seabed even if it is not within the jurisdiction of the United States.¹²⁶

There are, however, multiple differences between the two Acts. The Seabed Act is exhaustive in nature, whereas the Space Act is, on the contrary, almost lacking in regulatory framework. Unlike the Seabed Act, it does not contain provisions concerning environmental protection, liabilities, jurisdiction, licensing, or safety.¹²⁷

Another approach to the common heritage principle was taken in the case of the Antarctic region. The treaties surrounding the use of Antarctic resources are highly restrictive. The reasoning behind the restrictiveness is apparent: Antarctica's scientific value is immeasurable. Such a largely untouched natural biome is found nowhere else in today's world. Were the resource gathering in the area freed, it could cause a rush of commercial actors trying to capitalize on the land and its resources with little regard to the area's natural conditions. Recent studies have shown that there are bountiful natural resources under the thick sheet of ice, and the financial incentive regarding the area is massive.¹²⁸ Yet, to preserve such a fragile area, the Antarctic treaty has remained virtually untouched since it came into force back in 1998.

Antarctic resources are governed by a series of treaties known as the Antarctic Treaty System (ATS). The Antarctic region is also considered a common heritage of all mankind. In the introduction of the Antarctic Treaty of 1959, it is stated: "it is in the interest of all mankind that Antarctica shall continue forever to be used exclusively for peaceful purposes and shall not become the scene or object of international discord." The ATS differs from the deep seabed regime in that it does not have a singular governing body like the ISA, but instead, the ATS has divided all its member states into consultative and non-consultative parties. The consultative parties can make decisions regarding the utilization of the Antarctic region, whereas the non-consultative members do not have such powers. Another distinction between the ATS and the deep seabed regime is that in the ATS, all non-scientific mining and, thus, all commercial utilization is explicitly prohibited. In addition to this, the Protocol on Environmental Protection

¹²⁶ Foster 2016, p. 425.

¹²⁷ *Id.*, p. 426–427.

¹²⁸ See e.g. Thomas 19.11.2012.

to the Antarctic Treaty of 1998 indefinitely prohibits all mineral resource activity not associated with scientific research and provides that its terms may not be reviewed until 2048.¹²⁹

There has, however, been speculation regarding these terms being agreed upon only since there had been very few discovered resources in the area prior to the ratification of the treaty and hence the international community's interest in the region was only minimal.¹³⁰ If this treaty was negotiated today, the outcome might be entirely different. As with many international community matters, economic considerations were an important discussion when it came to both the deep seabed and the Arctic region debate. The same statement applies to the gathering of space resources: When the Antarctic treaty and the space treaties were ratified, those regions' sheer financial value was largely unknown. However, in deep seabed regulation, the financial benefits were already known, and the treaty was created accordingly. Now that the possible financial gains regarding commercial space mining ventures are known, the treaties should be amended accordingly.

Another issue that left the Moon Agreement mostly unratified lies in the non-appropriation principle stipulated in Article 11(2) of the Moon Agreement:

“The moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any other means.”

This principle is repeated in Article II of the OST:

“Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.”

One of the most substantial ambiguities concerning non-appropriation is the question of whether the term “national” appropriation also concerns the space activities of private and non-governmental entities. There are two approaches: the narrow and the broad interpretation. Stephen Gorove, for example, is an advocate of the narrow approach. Regarding the OST Gorove states:

"in its present form appears to contain no prohibition regarding individual appropriation - - an individual acting on his own behalf - - could lawfully

¹²⁹ Coffey 2009, p. 130–32 and Harn 2015, p. 629.

¹³⁰ Id.

appropriate any part of outer space, including the Moon and other celestial bodies."¹³¹

Some scholars also argue that the preparatory works of the OST indicate that the narrow approach of national appropriation is taken when drafting the treaty.¹³²

The scholars advocating for the wider scope interpretation argue that states are to control the activities of private entities, and as states they must obey international law. Thus, Articles II OST and 11(2) of the Moon Agreement together create a prohibition of private appropriation and thus prevent private entities from acquiring property rights for outer space resources. One argument for this view is that private appropriation would effectively negate the intended purpose of the non-appropriation principle, which is set in place to preserve celestial bodies so that they could be used non-discriminatorily as is intended in the common heritage principle. Even though many argue that the OST's preparatory works support the narrow view of national appropriation, the Moon Agreement's Article 11(3) still seems to support the broader approach. Article 11(3) stipulates:

"Neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or non-governmental organization, national organization or non-governmental entity or of any natural person. The placement of personnel, space vehicles, equipment, facilities, stations and installations on or below the surface of the moon, including structures connected with its surface or subsurface, shall not create a right of ownership over the surface or the subsurface of the moon or any areas thereof. The foregoing provisions are without prejudice to the international regime referred to in paragraph 5 of this article."

It is unclear which of the two views is the more generally accepted. The Moon Agreement's lack of widespread acceptance and its following ineffectiveness, however, tips scales towards the narrow approach. In addition to this, the United States' stance when establishing the Commercial Space Launch Competitiveness Act of 2015 indicates that they are narrowly interpreting these two articles. Thus, it could be argued that the narrow interpretation is the better-established one, although there is no clear consensus regarding the matter.¹³³

¹³¹ Gorove 1969, p. 349, 351.

¹³² Harn 2015, p. 639–641.

¹³³ Id.

There are vast ambiguities and shortcomings within both the common heritage principle and the principle of non-appropriation. The Moon Agreement requires the benefits of natural resource operations in outer space, an area of common heritage, to be shared by all, while leaving what this sharing in reality entails up for interpretation. The non-appropriation principle, on the other hand, leaves it completely unclear whether it encompasses not only the actions of states but also those of private and non-governmental entities. There have been multiple writings on both matters, but no clear consensus on what the principles entail has yet emerged. Thus, these legal frameworks demand clarification. The potential solutions to these issues will be discussed in chapter 5.2.

4.2.2 *The Commercial Space Launch Competitiveness Act of 2015*

As the many open-ended questions regarding space resource exploitation remain unanswered, the United States faced more and more pressure to act from the constantly developing space resource and outer space operations industry. The latest attempt to control this regime, the Moon Agreement, had fallen short, especially from the perspective of the countries with space-faring capabilities, and no substituting agreement was in sight. This pressure led the United States to adopt Title IV on Space Resource Exploration and Utilization in the 2015 U.S. Commercial Space Launch Competitiveness Act. The Commercial Space Launch Competitiveness Act provides support and a legal framework for the legal mining of asteroids by adding chapter 513 to Title 51 of the United States Code. This chapter consists of three separate sections, the most notable of which recognizes United States' citizens' and companies' property rights regarding resources in outer space after extraction on a first-come-first-serve basis. This chapter stipulates:

“A United States citizen engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to - - in accordance with applicable law, including the international obligations of the United States...”

This practically means that any allegations coming from anywhere outside the United States, claiming that space resource extraction is an illegal activity or that such an extracted resource would have to be shared under the common heritage principle, would not be recognized by any court within the United States.¹³⁴

¹³⁴ Von der Dunk 2017 p. 94–95.

As stated earlier, whether other states follow the view taken in the Commercial Space Launch Competitiveness Act of 2015 is critical in shaping the non-appropriation principle's future. Thus far, only a handful of states have been either sympathetic or expressed concern regarding the Commercial Space Launch Competitiveness Act. There have been two expressly sympathetic countries: Luxembourg, which announced the establishment of a law built around the framework of the U.S. Commercial Space Launch Competitiveness Act and the United Arab Emirates, which is aiming to create a similar regime with an emphasis on proper authorization and supervision of space operations.¹³⁵ There are two countries that have expressed their concern and dissatisfaction regarding the implementation of the Act: Russia and Brazil.¹³⁶

The Russian representative in the Scientific and Legal Sub-Committee stated that the Commercial Space Launch Competitiveness Act of 2015 showed disrespect towards international law. The representative stated that this was due to the U.S. effectively allowing the private sector to sell space resources by implementing the new Title IV, which, according to the Russian representative: 1) entails a new interpretation for the non-appropriation principle regarding outer space; 2) disregards much of the discussion surrounding the Moon Agreement, especially since these discussions have concerned the possibility of an international regime to control the framework of exploitation of outer space; and 3) presents the concept of "freedom to use outer space" as a fact of law, which, according to the representative, is not a law but rather a theory.¹³⁷

There is no international law currently addressing extracted resources from celestial bodies and there are provisions preventing the appropriation of celestial bodies, including asteroids, but there is no international law controlling the resources within those celestial bodies and their extraction. There have been multiple writings on the matters, as presented throughout this paper, but not one is yet to be deemed authoritative. Regardless, the majority view agrees with the Russian representative in that the sovereignty of natural resources in outer space is part of the sovereignty of celestial bodies, and thus the fact that no one can own the celestial bodies means that one cannot legally exploit resources from them.¹³⁸

¹³⁵ See e.g. Barnard 7.3.2016.

¹³⁶ See e.g. Evanoff 10.10.2017, Kaufman 8.2.2017, and Von der Dunk 2017 p. 95–99.

¹³⁷ Committee on the Peaceful Uses of Outer Space 2016, p. 5–7 and see e.g. Von der Dunk 2017, p. 97–98.

¹³⁸ Von der Dunk 2017, p. 97–98.

It is currently unclear whether or not other states will follow the United States and their interpretation of Article II of the Outer Space Treaty. This will, however, be a remarkable factor in settling the currently ongoing dispute regarding the non-appropriation principle.¹³⁹

5 ALTERNATIVE SOLUTIONS TO THE LEGAL FRAMEWORK SURROUNDING HELIUM-3

5.1 Alternative solutions for regulating dual-use goods

When it comes to dual-use goods regulations, the lack of harmonization creates a burdening effect. Due to the global nature of many exports, exporters often must deal with the dual-use control legislations of both ends of the transfer when exporting cross-borders. This puts a strain on national economies and the businesses within. The burden is particularly heavy on smaller businesses with limited capabilities to cope with the vast amount of dual-use laws. However, even if the system is overburdening at places, it also contains issues concerning under-inclusiveness.

One possible way to ensure that the systems do not become over-inclusive while still making the legal framework less burdensome could be the harmonization of the multiple different legal frameworks and export control lists surrounding dual-use goods. Evaluating all exports based on a global standard could possibly make the exchange of information and monitoring exports more efficient and transparent.

The dual-use control frameworks' effectiveness could potentially be enhanced by establishing a centralized and global database of export controls, which could be modeled after, for example, the Agreement on Trade-Related Aspects of Intellectual Property Rights' (TRIPS) common international rules to control both exporter and end-user licensing. As is written on the World Trade Organization's (WTO) website:

“The WTO’s TRIPS Agreement is an attempt to narrow the gaps in the way these rights are protected and enforced around the world, and to bring them under common international rules. It establishes minimum standards of protection and enforcement that each government has to give to the intellectual property held by nationals of fellow WTO members.”

¹³⁹ See e.g. Hobe 2016, p. 208.

Under the TRIPS Agreement, WTO members have considerable scope to tailor their approaches to IP protection and enforcement in order to suit their needs and achieve public policy goals. The Agreement provides ample room for members to strike a balance between the long term benefits of incentivising innovation and the possible short term costs of limiting access to creations of the mind. Members can reduce short term costs through various mechanisms allowed under TRIPS provisions, such as exclusions or exceptions to intellectual property rights. And, when there are trade disputes over the application of the TRIPS Agreement, the WTO's dispute settlement system is available."¹⁴⁰

Creating a similar system, tailored to the field of dual-use goods, could be a solution for the harmonization of the many dual-use goods control frameworks. In addition to this, a centralized authority with the ability to efficiently enforce the newly formed rules could assist in the efficient implementation of this system.¹⁴¹ This centralized authority could, again, be modeled after TRIPS, in which WTO functions as the enforcing authority.¹⁴²

Another possible solution to multiple problems within the dual-use control framework would be strengthening the Wassenaar Arrangement. There are many areas of the Wassenaar Arrangement that could potentially be improved. One of the most profound critiques concerning the Wassenaar Arrangement is the two overlapping issues of lack of information sharing and its missing pre-export consultation mechanism. Another noticed flaw in the Wassenaar Arrangement is the incentives for the Arrangement's members to act "outside" the Arrangement.¹⁴³

At its current, non-binding state, a breach of the Arrangement does not constitute a violation of international law. There is no real incentive to adhere to the Arrangement guidelines built into the arrangement itself. The only potential consequences of a breach of the Arrangement's guidelines are the potential political consequences of diverging from it.¹⁴⁴ Increasing the transparency of the export control license information-sharing mechanism could increase the political pressure on the Arrangements members, leading the members to be less likely to grant a license to a destination previously denied by another Arrangement member. Another matter to consider is having more frequent and mandatory reports concerning dual-use exports, which

¹⁴⁰ World Trade Organization, "Intellectual property: protection and enforcement".

¹⁴¹ See e.g. Lloyd 2004, p. 316–319.

¹⁴² World Trade Organization, "Intellectual property: protection and enforcement".

¹⁴³ See e.g. Lloyd 2004, p. 316–325.

¹⁴⁴ See e.g. GEO (Government Accountability Office, former Government Accounting Office) Report, Nonproliferation: Strategy Needed to Strengthen Multilateral Export Control Regimes (Oct. 25, 2002) supra note 34 and Lloyd 2004, p. 316–319.

would increase the system's transparency further. More frequent reporting would also allow the members to respond to potentially dangerous export end-users and materials quicker.¹⁴⁵

There are no provisions set in place within the Wassenaar Arrangement framework stipulating veto rights for the members of the Arrangement. Hence, there is no real no-undercut principle in place in the Wassenaar Arrangement. In its current form, this mechanism only provides that a member must notify the other members if they export goods to an end-destination previously denied by another member. Hence even if other members were to notify that they were to oppose the exporting of a certain item, such notification does not guarantee that the export will not be conducted.¹⁴⁶

If veto rights were to be suggested to be implemented to the Wassenaar Arrangement, it could potentially face loud opposition from the Arrangement's current members. Hence, there is a high possibility it would never be implemented. In his article "Restructuring the export administration act", Nathan Lloyd suggests a denial consultation mechanism instead:

Mandatory denial consultations can provide the necessary mechanism for increasing transparency and dealing with states acting outside the interests of Wassenaar. - - Under this proposal, member states would be forced to consult with one another before issuing an export license on a good that has already been denied to a non-member. If the member decides to go ahead with the transfer anyway, it would have to provide the denying nation with an explanation for its decision to grant the license.¹⁴⁷

According to Lloyd, this mechanism would increase both the strength and the transparency of the Wassenaar Arrangement through political pressure and more efficient monitoring of the members by the members. This mechanism would thus increase the system's transparency and hence solidify the Arrangement's authority.¹⁴⁸

5.2 Alternative solutions to the legal framework surrounding outer space resources

A dispute settlement mechanism modeled after the International Tribunal for the Law of the Sea (ITLOS) established in UNCLOS could be a potential starting point for a more effective

¹⁴⁵ Lloyd 2004, p. 316–325.

¹⁴⁶ Id.

¹⁴⁷ Id., p. 316–319.

¹⁴⁸ Id.

¹⁴⁸ Id., p. 319–325.

enforcement and governance system for outer space law. The deep seabed issue faced similar controversy as the gathering of outer space resources does now. For this matter, a specialized division, ITLOS, was created – The Seabed Disputes Chamber. The Seabed Disputes Chamber has exclusive jurisdiction over matters of deep seabed resources, including exploring and exploiting of the said resources. This body also works as an advisory body for matters regarding seabed resources.¹⁴⁹ UNCLOS Article VIII stipulates the possibility of establishing special arbitral tribunals regarding more specialized and technical issues. As space activities are often immensely technical – sometimes even literal rocket science, these kinds of specialized arbitral tribunals are worth considering. As in UNCLOS, the parties in disputes regarding outer space law would first attempt to settle the matter peacefully, and if this were to fail, the matter could be submitted to the nominated *ad hoc* tribunal.

To this date, the Moon Agreement has only been ratified by a total of 16 countries, and thus it is not widely accepted. The treaty, however, could be the solution to the ambiguities currently present in outer space laws. As a first step towards a better system, the Moon Agreement should be amended so that it would become more widely accepted and thus it would become more potentially ratified by a larger number of states. As stated above, a governing body for the purpose of governing and enforcing the laws of outer space would assist in effectively governing space activities and space resource exploitation as a *sui generis* system. This could effectively be achieved by finally giving force to the Moon Agreement's Article 11(5) when amending the treaty to a more enforceable form. Article 11(5) states:

States Parties to this Agreement hereby undertake to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the moon as such exploitation is about to become feasible.

As one can read from the treaty, it was already acknowledged that utilization of the resources was becoming ever more feasible. Sadly, since the treaty went largely unratified, the international regime was never established. By amending the treaty into a more appealing form, especially for the states with space-faring capabilities, such a body could finally be created after decades of hiatus. This body's most important function would be to clarify the currently open-ended questions regarding space resource utilization. The legal framework of the governing body could be modeled after the deep seabed regime since it is in its nature closely related to

¹⁴⁹ Crawford 2012, p. 734–737.

the matter of outer space resources, and the deep seabed regime's exploratory phase has already given promising results on the functioning of the mechanism.

Amending the Moon Agreement should be conducted bearing in mind that increased flexibility and increased ease of amending the treaties assists in avoiding similar issues that the rapid technological development has caused thus far. This issue could be solved by establishing the new amended Moon Agreement as flexible soft law, with the enforcing body, be it modeled after ISA or another *sui generis* mechanism, being the authority interpreting the existing laws and, if necessary, re-interpreting the newly established soft provisions according to technological development.

6 CONCLUSIONS

There are countless issues that humanity is currently facing, many of which, for instance, rapid population growth and climate change, are directly connected to the ongoing energy crisis. Not enough energy is produced for the Earth's ever-growing population, let alone that energy being clean. There exists a potential solution worth additional research – helium-3. However, as is outlined in this research paper, as it currently stands, the usage of helium-3 for the generation of energy would only be possible in small-scale operations due to its immense price. Even these small operations can bear serious financial risks for companies due to the strict dual-use control regimes.

Since helium-3's price is roughly \$1,4 million per kilogram, it would, regardless of the improvements in fusion technology, cost more to generate energy with helium-3 than such an operation could return in profits. This could, however, be changed by lowering the price of helium-3. By making it legally possible for these resources to be gathered both by governmental and private organizations, tapping into the Moon's helium-3 reserves could finally become plausible. This would enable bringing more helium-3 into the market, which would, in turn, decrease its price.

The first research question presented in this paper concerns the current status of the legal framework of space resources. By utilizing the legal dogmatic method from a legal historic perspective, this thesis demystifies the stagnant history of outer space laws. When the current legal framework governing space operations was designed, the launch of Sputnik 1 had been the main newspaper headline just a few years prior and states were the only considerable actors

to ever have the capabilities for space operations. In the modern, vastly developed world, private organizations are arguably in the frontlines of leading the modern space race. Hence, it is apparent why the outer space law, which has remained virtually unchanged after its commencement, is outdated. The evidence gathered in this research paper has shown that the treaties of outer space must be amended to reap the low-hanging fruit that are the potential benefits of space resources. Furthermore, by utilizing the legal dogmatic method, the existing outer space laws were systematized, and thus multiple issues were unveiled. The most critical of these issues are the principles of common heritage and non-appropriation, and the lack of a body governing operations in outer space.

The second research question presented in this research paper aims to answer the question on how the legal framework concerning resources in outer space should be amended, changed, or re-interpreted for it to enable the commercial mining of helium-3 in outer space. It can be concluded that the future of outer space laws is heavily dependent on the reformation of the Moon Agreement. In its current state, the Moon Agreement has many ambiguities, and space-faring states are unlikely to ever sign it as it currently stands. However, by clarifying the ambiguities within it, especially concerning the principles of common heritage and non-appropriation, the Moon Agreement could finally gain a wider acceptance. Hence, the obvious first step would be establishing a governing body for the purpose of governing and enforcing the laws of outer space. This could effectively be achieved by finally enforcing the Moon Agreement's Article 11(5), stating that the parties to the Moon Agreement undertake to establish an international regime to govern the exploitation of the natural resources of the Moon. Such a body could give the long-awaited clarifications to the Moon Agreement's vague terms.¹⁵⁰

To effectively clarify the issues present in the legal framework of space resource exploitation, creating a governing and enforcing body can prove beneficial. In order to study this matter, the functional comparative law method was utilized, and the space resource regime was compared to similar regimes, namely the ATS and UNCLOS. Gathered from the findings of this paper, it can be concluded that a similar system is already in place within the framework of the laws concerning the resources of the deep seabed. The deep seabed resources are in many ways similar to the resources located in outer space: both are considered common heritage of all mankind, and both contain valuable natural resources in a hard-to-reach location. To get to both locations, one needs to make heavy investments and have advanced technology often not

¹⁵⁰ See e.g. Harn 2015, p. 644.

available to developing nations. If a UNCLOS-like system were to be created, it would benefit both the countries extracting the resources and the non-space faring countries. This could be achieved by creating a body similar to the ISA, which would ensure that all nations' interests are considered and that the benefits and the technology required also reach the less developed nations. However, even if the issues concerning outer space were to be resolved, the issues concerning helium-3 as a dual-use item would still prevail on Earth.

The third research question presented in this research paper concerns the current status of the legal framework surrounding helium-3 as a dual-use item. This question was answered by systematizing the existing frameworks concerning dual-use goods utilizing the legal dogmatic method. The evidence gathered in this research shows, that the dual-use regimes are often burdensome for the actors of national economies due to the strict, extensive, and technical rules surrounding dual-use goods. Private companies, especially the smaller ones, often do not have the time, resources, or knowledge to cope with the bureaucracy caused by the many-step processes of acquiring export licenses. This is true especially, when exporting outside one's national borders, let alone when exporting to multiple countries and regions. The exporters must often be aware of multiple lengthy and technical lists concerning potentially dangerous items and end-destinations. To comply with these lists, complicated compliance programs often need to be set in place. This is not feasible for many smaller technology companies due to the lack of resources and knowledge.

However, finding the right balance between too much and too little regulation requires a lot of investigation. Both the alternatives of over-inclusiveness and under-inclusiveness can be detrimental – one for human safety and one for national economies and private companies, both big and small. It is indisputable to say that the biggest potential harm lies in under-inclusiveness – a business failing is not as critical of a problem as a terrorist organization acquiring a nuclear missile and potentially using it. This is why the field of dual-use goods is regulated over-inclusively – to *surely* prevent the latter scenario from taking place. Thus, to solve the dual-use framework's issues, the solution should be one that would make the system less burdensome and yet ensure that the laws surrounding dual-use goods are inclusive enough to protect the safety, health, and lives of citizens effectively.

The fourth and final research question of this research paper aims to answer the question on how the legal framework of dual-use goods should be amended, changed, or re-interpreted in order to enable the efficacious use of helium-3. Evidence gathered utilizing the functional

comparative law method by comparing different dual-use regimes and other similar regimes together shows, that a safer and less burdensome framework could potentially be achieved by establishing a harmonized regime for controlling dual-use goods globally. Evaluating all exports based on a global standard would make the exchange of information concerning exports more efficient and transparent. It would also make ensuring that the members comply with the relevant dual-use laws easier. Acting cross-borders is currently exponentially more difficult than acting nationally, which in and of itself can be devastatingly difficult. To increase the system's transparency, efficiency, and to lessen its burdensomeness, a centralized and global database of export controls could be established. This database could be modelled after the TRIPS Agreement by establishing a system of common international rules to govern exporter and end-user licensing, control lists, and end-destinations. This would allow the elimination of multiple slightly differing dual-use control mechanisms. This database and these rules would be governed by a centralized governing body, which could assist in efficiently enforcing the newly formed rules and in the efficient implementation of this system.

To lower the price of helium-3, space law regulations need to be amended, and to allow the efficient transportation, exportation, brokering, and trading of helium-3, especially globally, the dual-use regulations need to be harmonized and made more transparent. A possible solution to the world's energy crisis is within our reach. Now, all that is left is creating sensible legal norms to allow the efficient usage of helium-3 and hope that the field of fusion science finally reaches the much-anticipated breakthrough, bringing us closer to a greener world in which there is enough clean energy for everyone.